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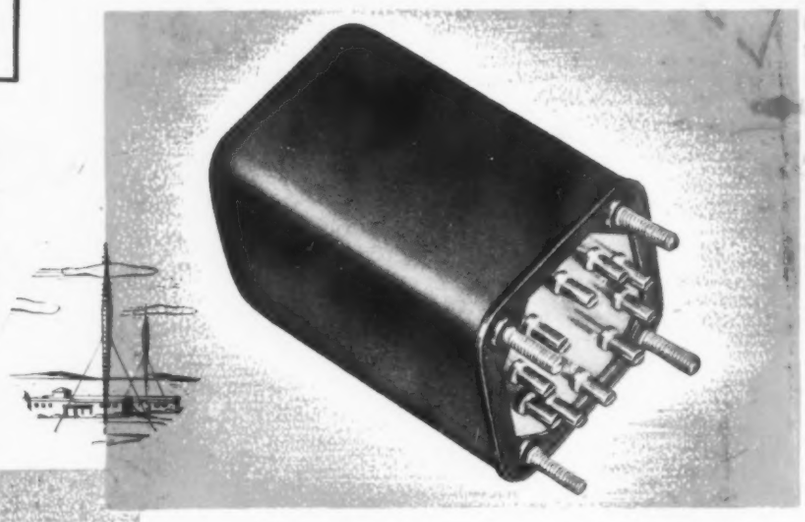

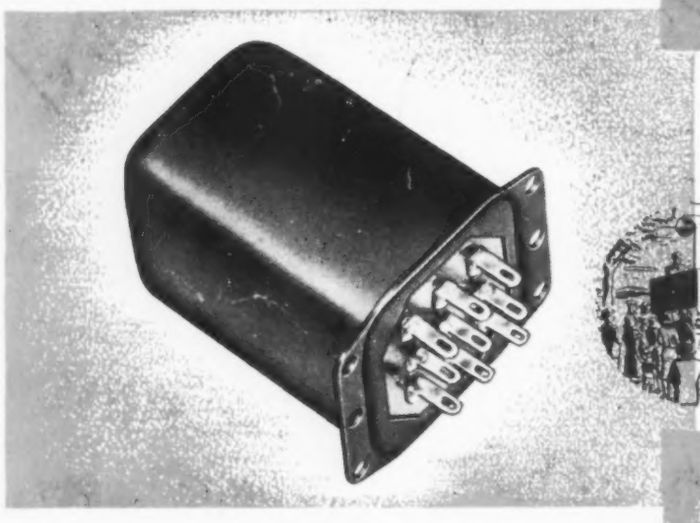

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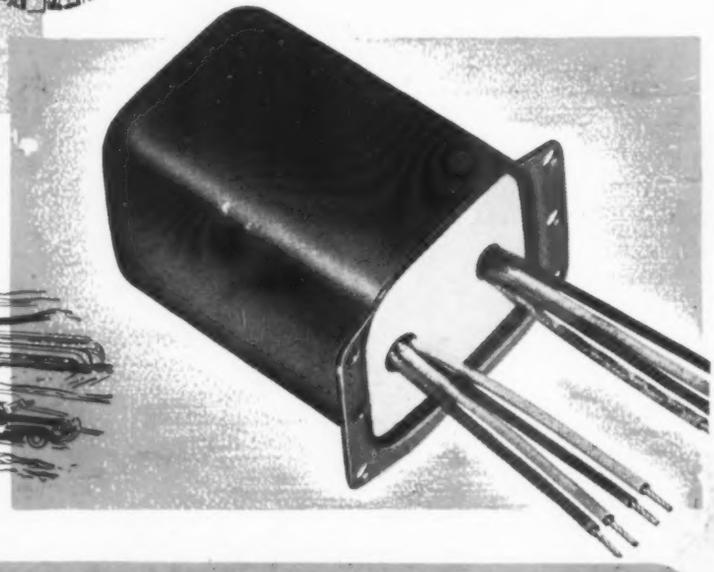

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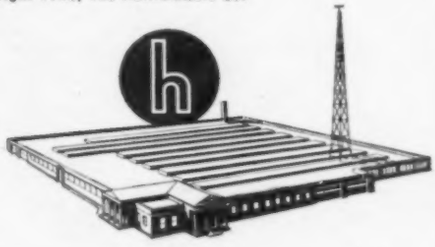

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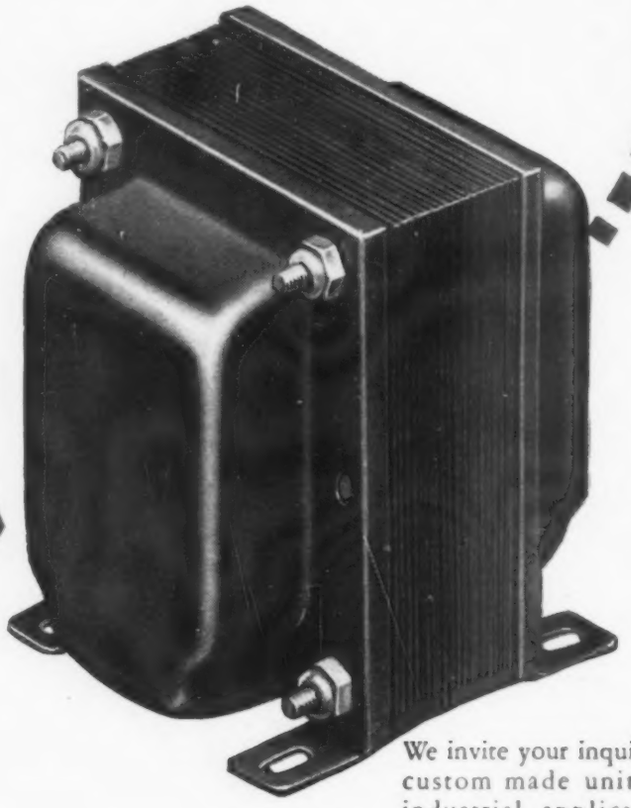

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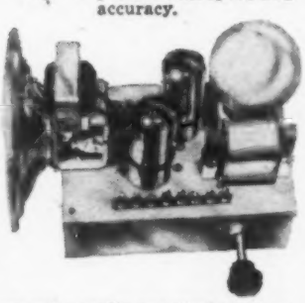

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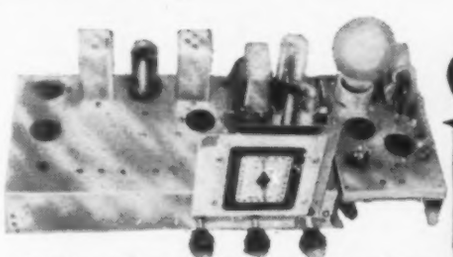

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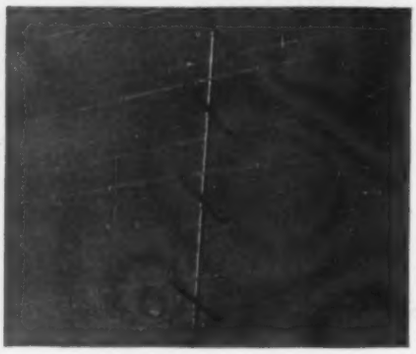

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For the RECORD

BY THE EDITOR

THE AM-FM DILEMMA

THE insistent demand by the public for FM receivers and tuners at low cost has resulted in a flood of low-priced units that leave much to be desired in the way of fidelity and performance. As a matter of fact, we find 5 and 6 tube, so-called FM receivers and 2 tube tuners being sold as representing the ultimate in FM broadcast reception. For the most part these little sets include speakers averaging six inches in diameter. Many models currently being offered will certainly do little to increase the popularity of FM. In fact, from many that we have heard, they certainly should discourage many a prospective purchaser from buying one when they hear the mediocre tone quality and when they compare the audio response to inexpensive AM sets in their possession. For several years the public has been sold on the merits of FM as a cure-all for the problem of securing high fidelity and static free reception.

In order to satisfy the requirements of true high fidelity and to take full advantage of the benefits of true FM, it is essential that a receiver have an excellent audio system (including a good speaker). How the manufacturers expect to justify the use of 69 cent five and six inch speakers in FM receivers (200-2500 c.p.s.) is not clear. The use of single beam power output stages, employing such tubes as 6V6, 50B5, etc. with as much as 10% distortion, will certainly not contribute to the listening pleasure promised for FM.

A few manufacturers have produced FM tuners without audio. They recommend that these units be fed into quality amplifier and speaker systems. That's a step in the right direction.

The noise suppression qualities of FM are lost in many receivers due to the use of trick methods of demodulation. For best results it is essential that the receiver have a high gain, sufficient to give adequate suppression action. This gain is needed regardless of the method of detection used. Now let's take a look at the frequency response capabilities of various types of receivers. The small table sets selling between $15.00 and $30.00 normally have a range from 200 to 2500 cycles-per-second. Larger table sets have a range of from 150 to 3500 c.p.s., consoles from 100 to 5000 c.p.s., and high fidelity consoles from 50 to 10,000 c.p.s. Does it not stand to reason then, if we are to enjoy the full benefits from FM transmissions we must have adequate consoles to house the equipment? Furthermore, for decent audio range we cannot get by with small diameter loud speakers with their many limitations *even if these speakers are installed in consoles.*

FM stations are looming on the horizon every day and production of FM sets continues at a high rate. The public is fully aware by now that satisfactory daytime AM reception is limited to the city dweller. Interference at night becomes more and more of a serious problem as new AM stations go on the air. At the present time there are about 2000 AM stations in operation. That's more than two times the number on the air on V-E Day. In addition there are more than 350 applications before the FCC for new AM stations. As new stations are placed in operation the increased interference problem becomes more and more acute. Reception, to all except the city dwellers, becomes progressively worse. As a result AM coverage in service areas, in most cases, has been reduced in alarming proportions. As a further complication, Cuba and Mexico are asking for more and more clear channel frequencies at the expense of those now used by U. S. A. stations. Cuba has asked for 12 frequencies for clear channel operation. This all adds to our present dilemma.

The behavior of FM signals do not recognize the difference between day and night time operations. On a watt-for-watt basis, FM will far outperform the coverage of AM stations as far as static-free, fade-free and interference-free primary service is concerned.

About 30 FM stations will operate with powers in excess of 100,000 watts, and a few of these will probably use close to 500,000 watts. Many millions of dollars are being spent for the proper installation of FM stations capable of high-fidelity transmission — but what about the receiving end? It is high time that we recognize and take full advantage of the superior capabilities of FM by selling *quality*—not just a "static eliminator."

If the trend towards 5 tube sets and 5 inch speakers continues the full benefits of FM will be of little value. It won't make much difference whether or not the signal wiggles back and forth or up and down. After all—it's what comes out of the speaker that counts!....O.R.

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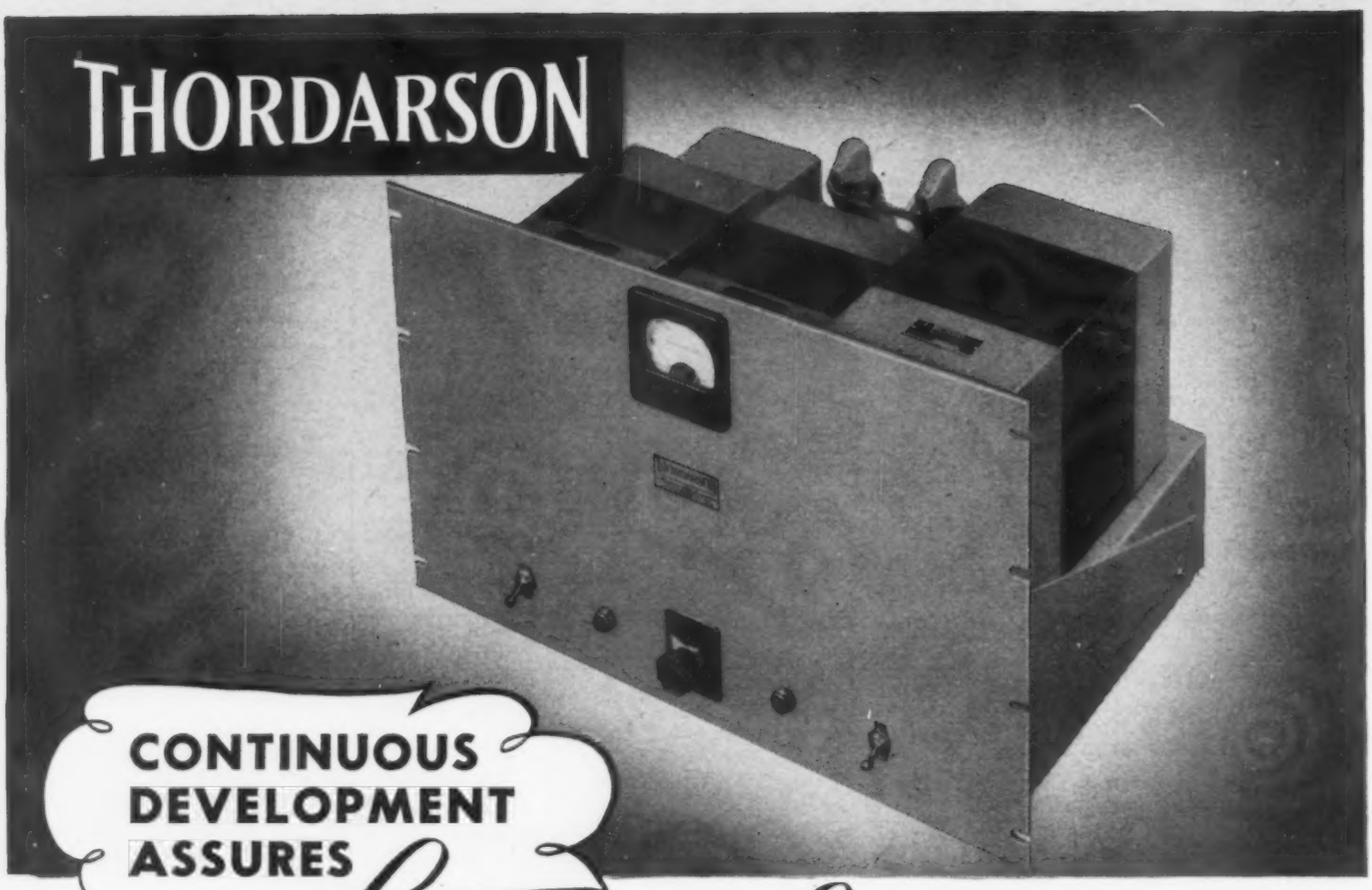

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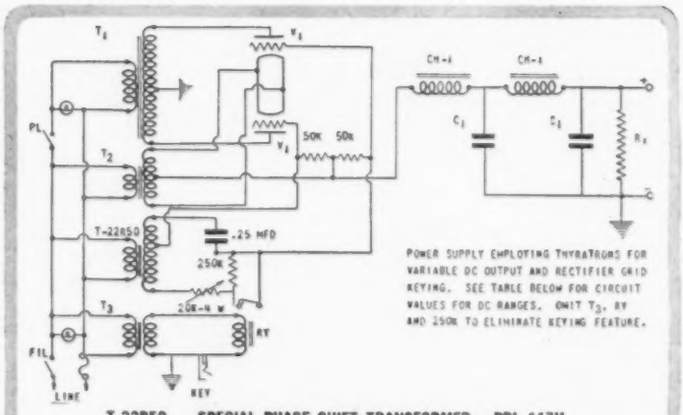

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Export — Scheel International Inc.

FOR THE NEWEST IN TV AERIALS

GREATER TV EFFICIENCY WITH NEW "HIGH-LOW" ARRAY BY WARD

Watch WARD

All major parts pre-assembled.
Saves costly installation time.

Here's another "first" by Ward in the rapidly expanding field of television reception. Advanced Ward design and engineering makes receivers work to their highest degree of efficiency.

That's the opinion of satisfied set owners, service installers, and major set manufacturers, who are all directly interested in the improved performance of television.

As a result of months of exhaustive scientific research and field testing, Ward now makes available a high band TV array which can be stacked above the standard television elements, and independently oriented! Also new is a kit for stacking two of Wards finest television assemblies into a two-bay array for a greater gain than ever before.

Sure, there have been other multiple antennas, but none with the scientifically measured spacing and complete adaptability of the new Ward models. You can see the difference yourself on the television screen when a "Magic Wand" aerial is connected to the set.

Send in coupon today for free copy of new Ward catalog.

ORIENTING AND GAIN. Each bay tilts in any plane, can be oriented in any direction to give sharpest focus possible. Eliminates awkward or tricky installations. Permits hairline adjustments for utmost gain on both the high and low band stations.

ADAPTABILITY. Ease of combination of assemblies in basic kits makes "Magic Wand" Aerials more adaptable than ever to the varying requirements of each installation. This superior flexibility means a highly specialized Ward TV aerial for each purpose, with fewer models in stock, no obsolescence, and greater profits! Write today for free catalog!

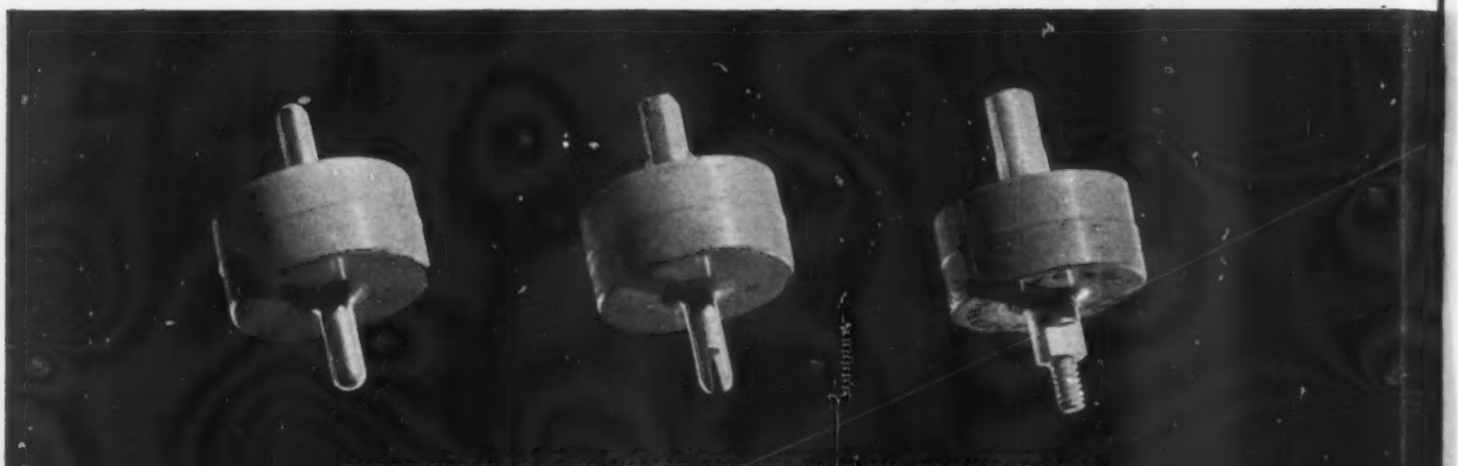
Please send me free copy of your new catalog showing latest developments in television aerials.
NAME_____
ADDRESS_____
STATE_____ CITY_____
IF JOBBER OR DEALER
COMPANY NAME_____

THE WARD PRODUCTS CORPORATION
DIVISION OF THE GABRIEL COMPANY
1524 E. 45th STREET, CLEVELAND 3, OHIO
IN CANADA: ATLAS RADIO CORP. LTD., TORONTO, CANADA

WARD *Magic Wand* AERIALS

WORLD'S LARGEST PRODUCERS OF ANTENNAS FOR CAR AND HOME

Announcing New Addition



THREE TYPES OF TERMINALS FOR FLEXIBILITY, CONVENIENCE

TV1-501 AND TV1-502 ROD TYPES: .160" diameter rod type terminals. For use with fuse or clip-type connections. Terminals are solid brass, silverplated and soldered directly to electrodes.

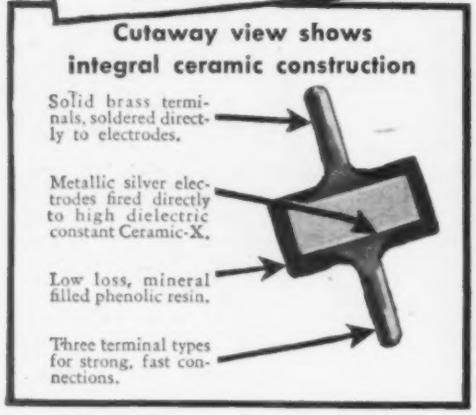
TV2-501 SLOT-AND-THREAD TYPE: .160" diameter with 1/16" x 3/16" slot in one terminal. Other terminal tapped 6-32, 3/16" deep for "twinning" or convenient chassis mounting.

TV3-501 DUO-THREAD TYPE: One terminal tapped 6-32, 3/16" deep full threads. Other terminal, 6-32, male thread 1/4" length. Designed for convenient series or tapped series connections.

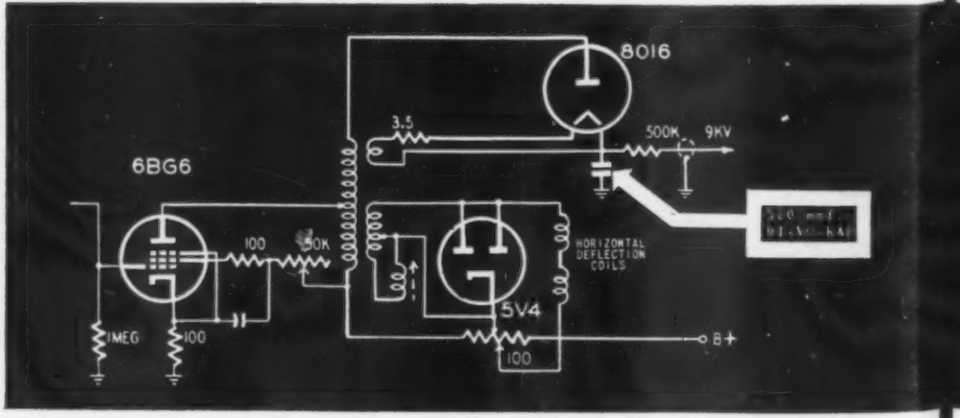
Centralab Unit	User	Mfg. Part Number
TV1-501 List Price $1.75	Andrea Radio Corp.	HCH2701
	Allen B. DuMont	3-14-41
	Industrial Telev.	
	Philco	30-1299
	RCA-Victor	M-940173-1
	Stromberg-Carlson	110504
	Crosley	W137477-1
TV2-501 List Price $1.75	Admiral	65A11-1
	Fada	17.41
	Garod	
	Sonora	N6917
	Telequip Radio	
	Motorola	21A90013
TV3-501 List Price $1.75	Cleervue Telev.	BB106
	Consolidated Telev.	
	Lectrovision Inc.	
TV1-502 List Price $2.25	Allen B. DuMont	3-1488

LOOK FOR "HI-VO-KAPS" ON CURRENT TV SETS!

Already in use on television equipment of leading manufacturers (see table), *Hi-Vo-Kaps* were designed and developed by Centralab to meet the stated requirements of television project engineers. Save this handy table to check users, prices and parts numbers.


Cutaway view shows integral ceramic construction
Solid brass terminals, soldered directly to electrodes.
Metallic silver electrodes fired directly to high dielectric constant Ceramic-X.
Low loss, mineral filled phenolic resin.
Three terminal types for strong, fast connections.

New Centralab *Hi-Vo-Kaps* made with Ceramic-X, combine high voltage and small size for television and high voltage applications. Diameter 1.000", Length .510".



Circuit diagram of simplified typical television power supply shows where and how *Hi-Vo-Kaps* fit into this high voltage by-pass application. Ceramic construction of *Hi-Vo-Kaps* assures long life, dependable performance under all types of operating conditions. The word *Hi-Vo-Kaps* is a registered trade mark.

to Your Centralab Line!

New "HI-VO-KAPS" give you high voltage television capacitors made with Centralab's Ceramic-X!

THE SMALLEST high voltage capacitors ever developed exclusively for television circuits — that's what Centralab now offers you to help you take care of your growing television business!

Yes, Centralab's new *Hi-Vo-Kaps* are for use as filter and by-pass capacitors in video amplifiers or amateur equipment — for high DC voltages with small component AC voltages (not for use in temperature or resonant circuits).

Notice the variety of terminal connections which *Hi-Vo-Kaps* provide to fit almost any television or other high voltage application. You can be sure, too, of long life and dependable performance because *Hi-Vo-Kaps* are made with high dielectric Ceramic-X, combining high voltage and small size, with positive resistance to humidity and moisture.

Now's the time to stock up on these important new capacitor components! See your Centralab representative for complete information about *Hi-Vo-Kaps,* or write direct to Centralab, Division of Globe-Union, Milwaukee, Wisconsin.

RATINGS

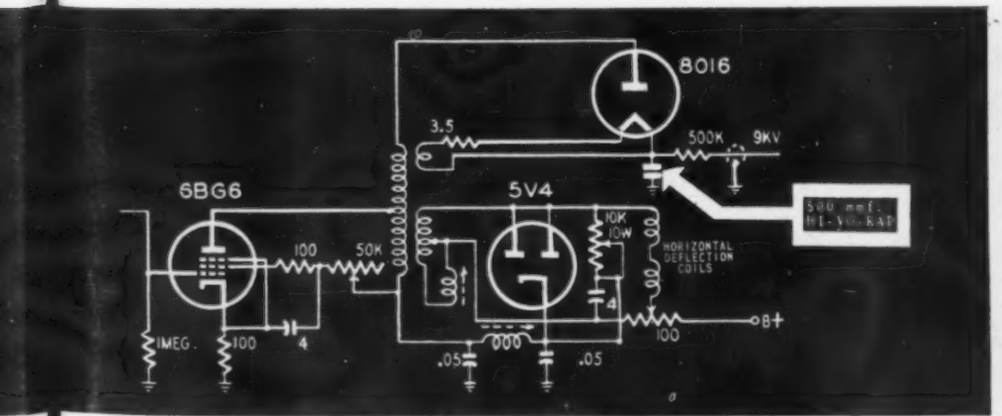
TV1-501 . . . TV2-501 . . . TV3-501

10,000 WVDC, 20,000 VDC Flash Test, Capacity — 500 mmf

TV1-502

20,000 WVDC, 30,000 VDC Flash Test, Capacity — 500 mmf.

Centralab
CRL
Division of GLOBE-UNION INC., Milwaukee



Circuit diagram of power supply, now widely used in commercial television receivers, shows *Hi-Vo-Kap* application. *Hi-Vo-Kaps'* positive resistance to humidity and moisture is your guarantee of top quality operation and long term service satisfaction. Ask your Centralab representative about *Hi-Vo-Kaps.*

Watch for something new and exciting from Centralab at the Chicago Show! A new product and a big new sales opportunity. Don't miss Centralab's Booth 108!

Listen... 4 New Jensen Hypex* PROJECTORS

AFTER months in the laboratory and a long and costly tooling program, this dominant new line of HYPEX Projectors is now ready. In their design, JENSEN engineers started with complete recognition of the shortcomings of all equipment of this kind and then added their own high concepts of performance and convenience requirements. The result is a striking new high in every detail of design and performance, and a new low in price.

Generous use of such materials as stainless steel and other corrosion-resistant materials, plus elaborate treatment of necessary steel parts, insures against weather exposure. Mounting brackets using clutch-type, heavy trunnion mountings (on all except VH-91), solve finally the problem of adjustment and positive locking into position.

Weatherproof terminal boxes provide a long needed feature in equipment of this kind. The completely new driver unit with molded plastic diaphragm is entirely enclosed within the one-piece rigid horn. And, of course, the recognized superiority of the Hypex formula is employed in the reflexed horn design.

The sound industry has long deserved equipment of this kind. Now it is here and at prices right back to prewar levels.

Write or wire for complete information, we haven't space here to give more than an outline of the features and performance ability of these outstandingly new products.

JENSEN MANUFACTURING COMPANY
6617 S. LARAMIE AVE., CHICAGO 38
In Canada: Copper Wire Products, Ltd., 11 King St., W., Toronto

*PATENT 2,338,262. TRADE MARK REGISTERED.

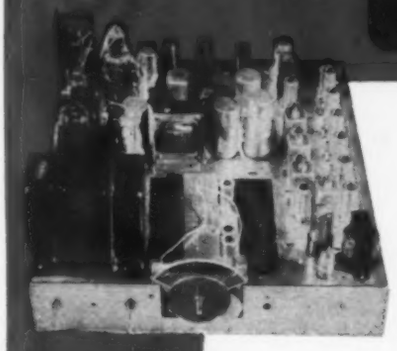
Jensen

TELEVISION ASSEMBLY CO.

INTRODUCES THE

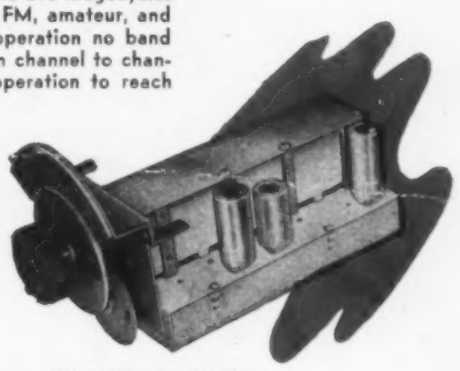
Champion Models

with



DUMONT INPUTUNER

The Dumont Inputuner tunes continuously from 44 to 216 megacycles without a break, covers all 13 channels as well as FM, amateur, and aviation channels. For ease and convenience of operation no band switching of any kind is required when tuning from channel to channel with the inputuner system. Just one simple operation to reach any desired station.



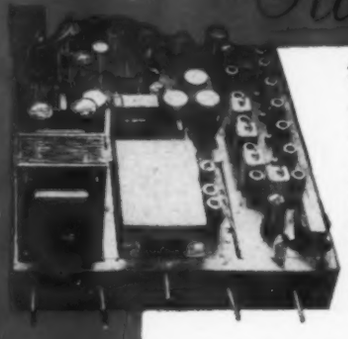
Assemble the Champion model of your choice, 10" flat surface screen picture, 51 sq. in. picture, 12" screen picture with 75 sq. in. picture or the 15" screen picture with 120 sq. in. picture.

All Champion Models are complete with all tubes and components including the CR Tube.

10" FLAT SURFACE	12" SCREEN PICTURE	15" SCREEN PICTURE
$ 273.10	$ 303.10	$ 393.10
DEALERS NET	DEALERS NET	DEALERS NET

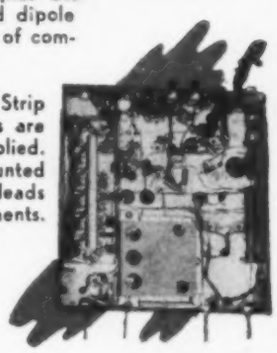
Standard Models

NOW AVAILABLE WITH THE STANDARD MODELS—FM RADIO AT A SLIGHT ADDITIONAL COST OF $7.95



All Television Assemblies are complete and include: 29 RCA Tubes plus CR Tube—Heavy duty RCA 6.8 oz. slug PM speaker—Specially designed dipole antenna, with 60 ft. lead in—complete pictorial charts for placement of components and schematic diagrams for wiring supplied with assembly.

Superior performance is obtained with a new IF Video & Sound IF Strip (Pat. Pend.) aligned, wired, pretuned, tubed and tested. All circuits are contained on one chassis ready to use with the front end unit supplied. This front end will handle 13 channels and is aligned and tested, mounted on a separate chassis. Merely connect B plus filament and output IF leads to the television chassis. It is not necessary to make any RF alignments. These units utilize a clipper circuit which filters out ignition noises.



10" FLAT SURFACE	12" SCREEN PICTURE	15" SCREEN PICTURE
$ 229.50	$ 259.50	$ 349.50
DEALERS NET	DEALERS NET	DEALERS NET

TERMS: 10% DEPOSIT WITH ORDER. BALANCE EXPRESS COLLECT.

Guaranteed All Television Assemblies are guaranteed to operate to your satisfaction when simple directions are followed.

IN CHICAGO MAY 11TH-14TH
SEE OUR EXHIBIT AT THE CONGRESS HOTEL

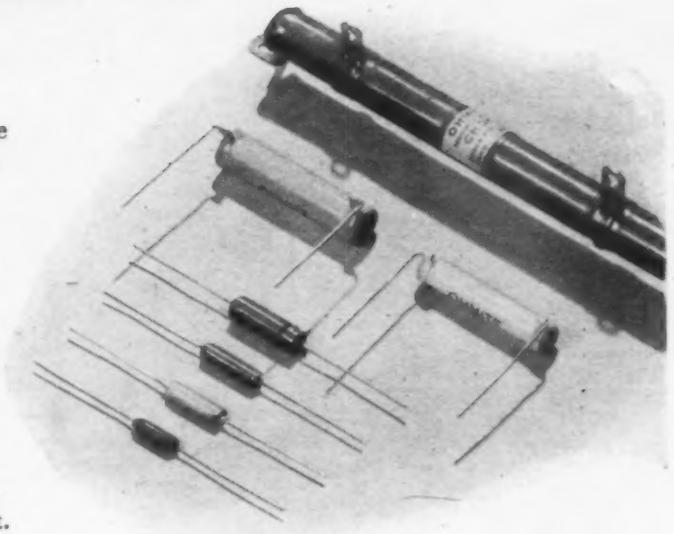
TELEVISION ASSEMBLY CO.

540 BUSHWICK AVE.
BROOKLYN 6, N. Y.

OHMITE plate chokes

"FREQUENCY-RATED"

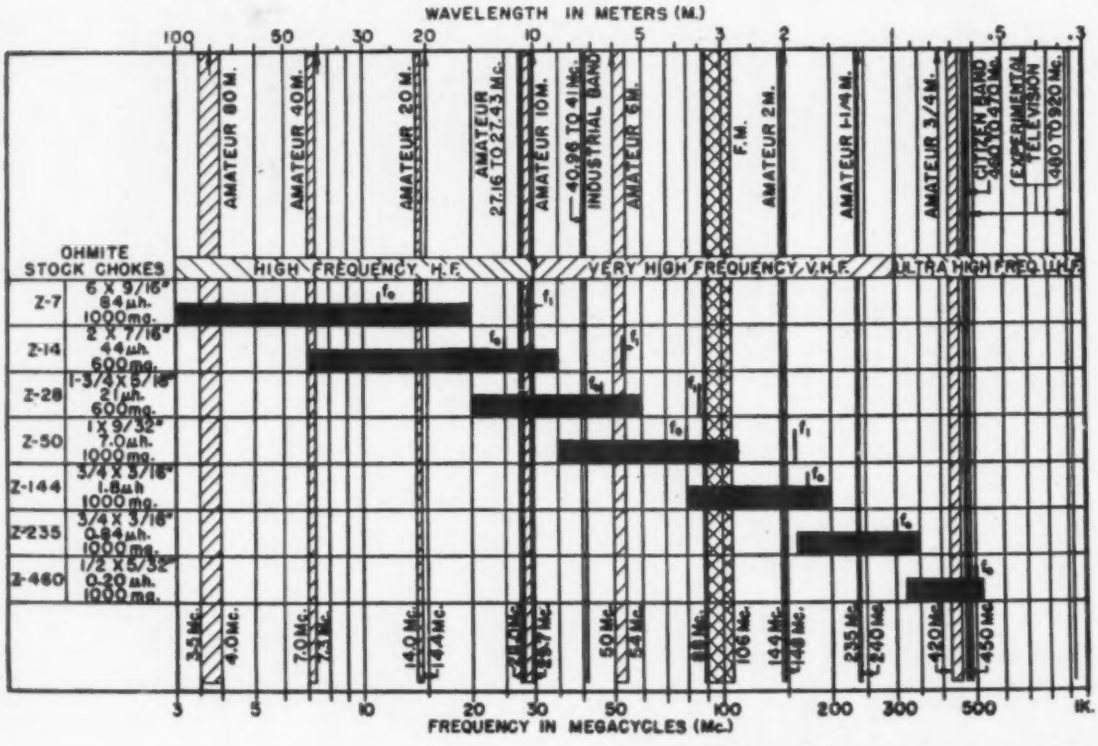
for easy selection and top performance



● Now, for the first time, you can select a plate choke for a particular frequency and know that it will give excellent performance at this frequency. The Ohmite line of plate chokes are "frequency-rated"—their frequency characteristics have been accurately predetermined. The chart below gives the operating frequency range for each of the seven sizes.

Ohmite single-layer wound, r.f. plate chokes cover the entire frequency range of 3 to 520 megacycles. These chokes are wound on low power factor plastic or steatite cores, and are insulated and protected by a moistureproof coating. All chokes are rated 1000 ma except the Z-14 and Z-28, which are rated at 600 ma. Further information will be supplied upon request.

RECOMMENDED OPERATING FREQUENCY RANGES OF OHMITE R. F. PLATE CHOKES



WRITE FOR PLATE CHOKE BULLETIN No. 133.

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OHMITE MANUFACTURING COMPANY

4884 Flournoy St.,
Chicago 44, Ill.

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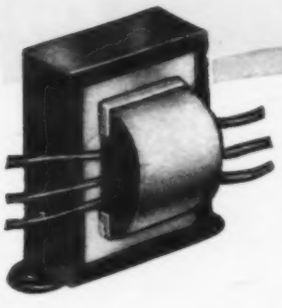

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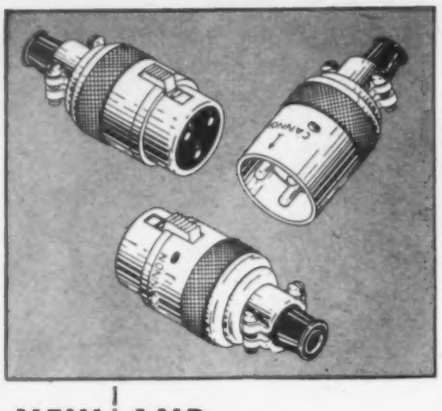
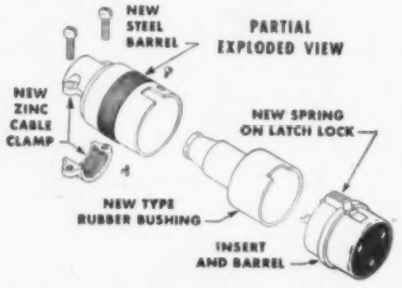


NEW AND IMPROVED TYPE "P" PLUG

On December 1st, 1947, Cannon Electric announced the completion of a new Type "P" to replace the P-CG-11 and P-CG-12 straight cord plugs. At the same time, list prices on all "P" fittings were revised, mostly up, a few down.



The new -11S and -12S plugs replace both the old -11, -12 and former -11S, and -12S. Features of the new fittings are shown by arrows on the view above. The shell is lightweight steel with an integral clamp of zinc. The zinc clamp is superior to the removable clamp and prevents twisting of leads. The rubber bushing adds insulating factors within the solderpot cavity and acts as a cable relief on the P2, and P3. The latch is stronger and better than on the old design.

For complete information, write for Special Bulletin No. PCG-1, and any other catalog material which you may require. Please use your company stationery when writing. Address Dept. E-228.

SINCE 1915

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WORLD EXPORT (Excepting British Empire):
FRAZAR & HANSEN, 301 CLAY ST., SAN FRANCISCO

Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By FRED HAMLIN
Washington Editor, RADIO NEWS

THE WAY THINGS ARE GOING, don't be surprised if television turns out to be the runaway best-seller in electronic circles this year. Production, sales, and public acceptance of the new medium is progressing great guns and there is every indication that the spring boom in video is only a sample of the sensational progress to come during the summer, fall, and winter.

STRAWS-IN-THE-WIND were pre-spring production figures which, while of course not in the same bracket with FM sets, nevertheless rivalled percentage-wise that division's equally sensational rise last year. Latest tabulations of the Radio Manufacturers Association indicate that television production during February totaled 35,889 or 5888 ahead of the January figure and 141 per-cent ahead of the 1947 monthly output. The February rate indicates an annual production during the year of nearly half a million sets. That's almost twice the total television output since the end of the war.

THERE'S A LOT more news on television this month, but before going into details it should be noted that other branches of the industry are doing much better than all right as far as production goes. RMA figures, representing 90 per-cent of the industry, showed for February an AM-FM output of 140,629 units, up 4614 from January. The total was less than the average during the last quarter of '47, but that was something that the industry had long since anticipated, seasonal buying being what it is. Over-all set production in February reached 1,379,605 units, comparing favorably with a year ago and ahead of the January score of 1,339,256. Portables and auto sets were coming off the lines in increasing numbers. In the AM-FM-television field, smaller sets were also playing leading roles. A total of 36 per-cent of the AM-FM production was table models and converters, while table models in television accounted for a startling two-thirds of the production.

ANOTHER THING, reports from all over indicate that television is by way of attaining its long-dreamed-of goal—mass acceptance. The bar trade started the ball rolling, as was noted here last year, but now it's almost understatement to say that everybody's reaching for sets. Recent surveys indicate that a sizeable percentage of buyers are from the less prosperous side of the tracks. Another potent factor that figures in the spring audience news is the coke-and-sundae trade—everything on two legs from the ages of six to sixteen. Maybe you've already heard the story of the younger-younger generation character, aged five, who, on being taken to his first movie, said: "Look, mummy, television!" More and more frequently, kids are seeing television before they see movies, and the medium is already being hailed as having excellent juvenile educational possibilities. Indicative of the trend is a recent story in the New York Sun about one Charles Feldman, who runs a candy store on New York's East Side. Feldman reports that he fills his store with junior-juniors all the way from grade school kids (afternoons and early evenings) through high schoolers (late evening). Reason; a video receiver. Incidentally, the Feldman story gives you an idea how television has reached the small-income groups: the candy store is in the lower East Side, heart of a community where Manhattan's lowest income groups reside.

ON THE TELECASTING front, big things have been doing and bigger are promised in the months to come. By now, if you haven't heard tell of the U. S. Treasury's Security Loan Drive—well, you've just been out of circulation. But maybe something that you didn't hear was that television played a leading role in getting the drive started. To high treasury officials as well as TV leaders, the effort was history-making. It marked the first attempt by a government agency to recruit volunteers and to let the public sit in, visually as well as with sound, with a national planning conference. The conference, held in Washington March 18-20, was attended by some of the nation's leading financial and business leaders, who told their Security story to television screens. Also to at-

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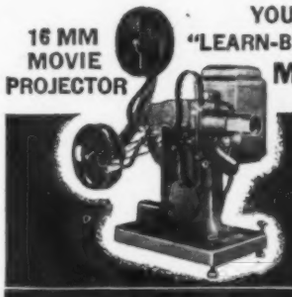

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☐ If under 16, check here for special information.

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MERIT Model "D"

POINT OF
GREATEST SAVING

SPECIFIC APPLICATIONS are constantly calling for new advance in types of transformers — a challenge for which MERIT, with its long specialization and plant facilities, is well equipped to meet. With MERIT only one thing remains unchanged in this changing science — MERIT QUALITY.

MERIT MODULATION TRANSFORMERS
For Specific Applications

Type No.	List Price	Output Tubes	Ohms Impedance Pri.	Sec.
A-3110		PP801, 6L6, 10, 46 HK-24, HY-25....	10000-6600CT	4000-5000 7500-10000 12000
A-3113	$15.75	PP800, 809, TZ-40, T-55, HK-54, RK-31, HY-40, 811, 807	15000-6900CT	3000-4000 5000-6000

Dimensions

	Max. Pri.	MA Sec.	Watts	H	W	D	Mtg.
A-3110	175	150	60	4¼	3½	3¾	D
A-3113	250	300	175	4⅝	3 13/16	5⅝	D

MERIT COIL & TRANSFORMER CORP.
TELEPHONE
4427 North Clark St. Long Beach 6311 CHICAGO 40 ILL.

tract attention of volunteers were chalk-talks by a battery of famous cartoonists led by Rube Goldberg. Recruitment of bond salesmen in areas reached by television was rapid and spontaneous as a result, Treasury leaders report.

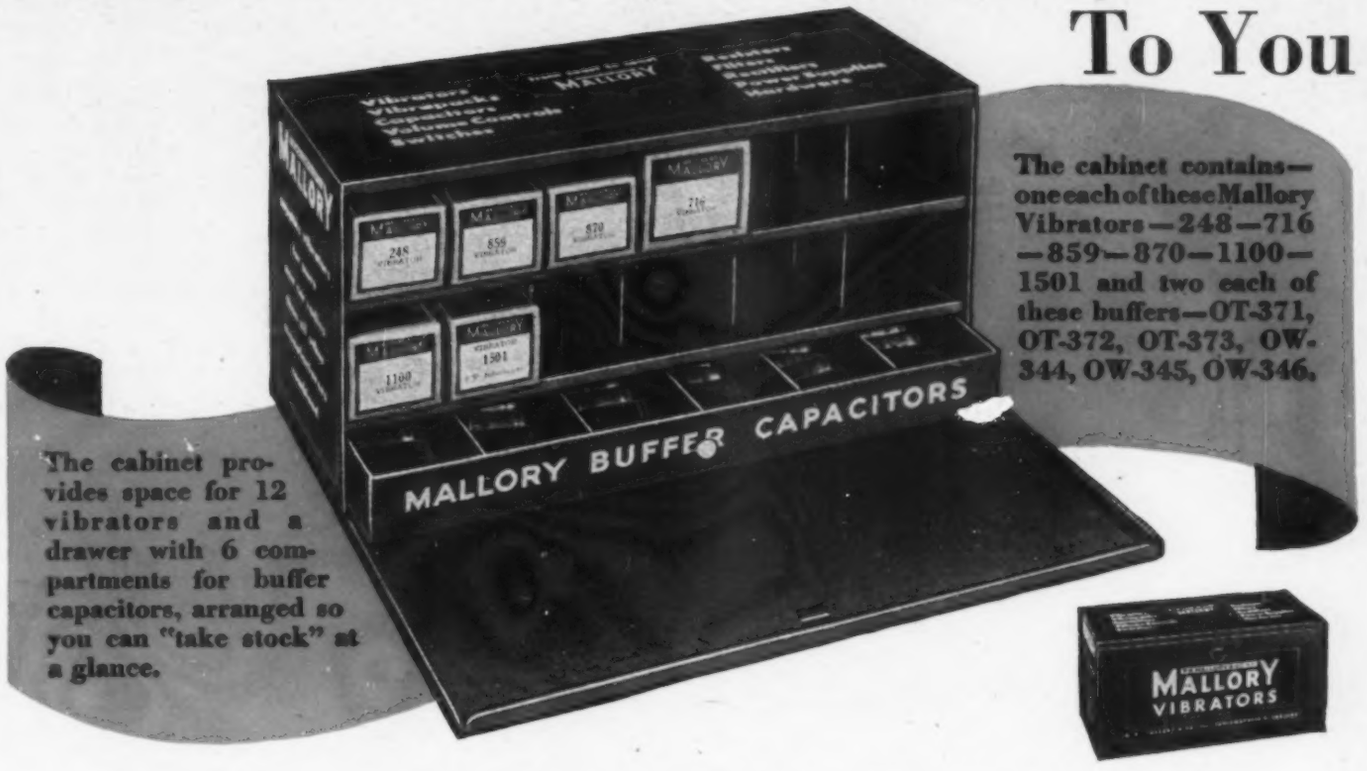
AS FOR THE FUTURE—among other things, you will be able to attend both national political conventions via video. What's more—we checked this around town the other day—both national headquarters are planning special TV programs during the sessions. Everybody is happy about the whole thing from what we can gather, and happiest, perhaps, are the television engineers. In case you don't know, it's one whale of a job getting video equipment set up for anything as colossal as a political convention, and to make separate installations for both Republicans and Democrats would multiply the work by two. But the politicos have obligingly eliminated the problem by scheduling their meetings in the same place—Convention Hall, Philadelphia, where the Republicans will face up to the mikes beginning June 21, the Democrats beginning July 12.

INCIDENTALLY, looks as if broadcast advertising, though now including both FM and television, isn't falling off so far as AM is concerned. Indeed, if 1947 figures recently completed by the Federal Communications Commission are an indication, AM is still doing fine. Net time sales, according to the FCC report, showed a 5.6 per-cent increase over '46. The report covers the four national networks, their ten key stations, three regional networks, and 821 stations. Sales for the four national networks and their ten key stations totalled $72,352,636, up 3 per-cent over 1946. Three regional networks were up 1 per-cent. FCC adds that preliminary reports from 343 new stations licensed during 1947 showed an average monthly income of about $5900. Total broadcast revenues of these stations came to an estimated $15,261,819 . . . How much of this money went to radio workers hadn't been figured as we go to press, but FCC did report on the payroll score in '46. It shows the tab on 1015 stations, excluding networks keys, and shows a jump from $7,483,715 paid to 29,571 employees in January, '46, to $11,300,760 paid to 32,548 employees in December of the same year. Total 1946 payroll was more than a hundred million dollars, FCC reports. Not bad, not bad.

WE'VE BEEN EXPECTING this one for a long time, but not until recently was anybody willing to stick out his neck and ask for it. Now FCC reports that it's happened—there's now a station

(Continued on page 191)

Another Good Deal–From Mallory To You



The cabinet contains—one each of these Mallory Vibrators—248—716—859—870—1100—1501 and two each of these buffers—OT-371, OT-372, OT-373, OW-344, OW-345, OW-346.

The cabinet provides space for 12 vibrators and a drawer with 6 compartments for buffer capacitors, arranged so you can "take stock" at a glance.

The Fastest Selling Vibrators in the Finest Line Made—

The Mallory "2448 Vibrator Deal"

Mallory, first producer of the vibrator, builder of the sturdiest, most reliable vibrators made, offers you an attractive deal on this important replacement part. A fast moving selection of 6 vibrators, that will cover 75% of your requirements, together with an assortment of 12 buffer capacitors (2 each of 6 ratings), in an attractive metal cabinet at a net price of $24.48 to the serviceman.

This is the serviceman's regular price for these parts; no charge is made for the cabinet. You sell the parts for $40.80—make your full $16.32 profit.

Your Mallory Distributor has them in stock for immediate delivery. Place your order now, and get this handsome, convenient cabinet for *your* shop.

More Mallory Vibrators are in Use Than All Other Makes Combined

WHAT WILL MALLORY DO NEXT?

See Us at the Radio Parts Show

P. R. MALLORY & CO. Inc.

MALLORY

CAPACITORS . . . CONTROLS . . . VIBRATORS . . .
SWITCHES . . . RESISTORS . . . RECTIFIERS . . .
VIBRAPACK* POWER SUPPLIES . . . FILTERS

*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Power Unveiled

Here it is! The answer to a thousand problems . . . possible because of the skillful design and engineering that has made Radiart the leader. We are proud to unveil this POWERFUL VIBRATOR in conjunction with the annual Chicago showing, an event of great moment. The old rotary inverter is replaced with this rugged vibrator where high voltage changes from D. C. to A. C. are required. This advanced design incorporates vast improvements on anything the field has previously known, and has a wide variety of industrial and domestic applications.

See this, and other Radiart products at our display booth.

STANDARD OF COMPARISON

RADIART

The Radiart Corp.

CLEVELAND 2, OHIO

Make More Money in Radio TELEVISION & ELECTRONICS NOW!

You build this fine modern Superheterodyne Receiver and other units, with the complete standard parts we send you. This valuable equipment becomes yours to use and keep.

Get these 2 BIG BOOKS FREE!

If you are already employed in the great Radio industry, you know how great the demand is for trained, experienced servicemen, operators and technicians. You know how fast the field is growing and how important it is to keep up with new developments in F.M., Television and Electronics. The Radio industry is alive with opportunity for the qualified technician whose knowledge is **up-to-the-minute.** You can be an FM., and Television specialist . . . get into the lucrative Radio Service Field . . . own a business of your own, if you prefer. National Schools of Los Angeles, for over 40 years a practical resident and home study trade school, has put into effect its New 1948 Training Program. This program, adapted to National's Master Shop Method Home Study Course, can qualify you in your spare time as a Radio and Television technician. For details of this Program fill out and mail the coupon below.

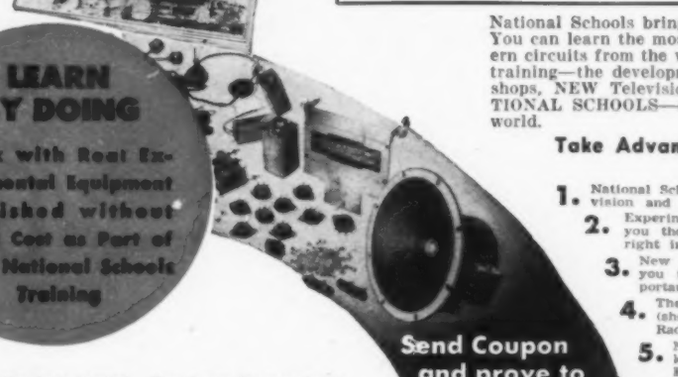
NOW! New Professional Multitester Included! This versatile testing instrument is portable and complete with test leads and batteries. Simple to operate, accurate and dependable. You will be able to quickly locate trouble and adjust the most delicate circuits. You can use the Multitester at home or on service calls. It is designed to measure AC and DC volts, current, resistance and decibles. You will be proud to own and use this valuable professional instrument.

SHOP METHOD HOME TRAINING
FROM A TECHNICAL TRADE RESIDENT SCHOOL

National Schools brings its exclusive Shop Method of training right into your own home. You can learn the most up-to-date approved practical training projects, systems and modern circuits from the very beginning in your spare time. Here is sound and practical home training—the development of experienced instructors working with students right in the shops, NEW Television and Broadcast Studios and Experimental Laboratories of NATIONAL SCHOOLS—one of the most advanced technical trade education centers in the world.

LEARN BY DOING

Work with Real Experimental Equipment Furnished without Extra Cost as Part of your National Schools Training



Take Advantage Now of these Outstanding Features of National Schools 1948 Training Program

1. National Schools' 1948 Course is planned to prepare you for real success in Radio, Television and Electronics.
2. Experimental equipment supplied with the Course has been completely revised to give you the most **up-to-date** practical experience with new circuits, new units, etc., right in your own home.
3. New Television Lessons have been expanded to give you training in the latest developments in this important field.
4. The 1948 Course includes a Professional Multitester (shown above) for your use in spare or full-time Radio work.
5. National Schools gives you **advanced** training—the key to the **better** positions in Radio, Television, Electronics.
6. You are sent standard Experimental Equipment, including tubes and accessories, for building a modern Short Wave and Standard Broadcast Superheterodyne Receiver. All equipment becomes your personal property.
7. National Schools' 43 years of experience in Technical Trade Training . . . our modern shops and laboratories . . . highly trained instructors are back of your time-tested Training Plans for a brighter future.

Both Home Study and Resident Training Offered

Approved for Veterans

Check Coupon

Send Coupon and prove to yourself what YOU can do in *RADIO* and *TELEVISION*!

Experience is the best teacher. You learn by experience with the exclusive National Shop-Method of Home Training. With the apparatus sent you, you actually build various types of standard equipment—a powerful superheterodyne receiver, a signal generator, an audio oscillator, low power Radio transmitter and other units. You make tests and conduct experiments that **show you the why and how of Radio.** You understand what makes the various elements of Electronics operate because you actually see them work for you. Not only do you gain splendid experience by this method of learning, but you receive valuable equipment you will use on the job in the practice of your profession as a Radio Technician. **Mail the coupon** and learn what this means to you.

FREE LESSON INCLUDED

Examine the exclusive National Shop Method of Home Training. See for yourself how sound and practical it is. Be convinced that you can learn Radio, Electronics, Television—quickly and easily in your spare time. This trial is ABSOLUTELY FREE.

Mail the coupon here for the books that tell you the complete story of National Schools Master Shop Method of Home Training in Radio, Electronics and Television.

This is the MODERN SYSTEM OF TRAINING, it matches the rapid progress constantly being made in Radio, Television and Electronics. It is TIME TESTED, too. National Schools has been training men for more than a third of a century. It is the very same training that has helped thousands to more pay and greater opportunity. You owe it to yourself—your future—to read the book "Your Future in Radio, Electronics and Television"—FREE to you when you send in the coupon.

G. I. APPROVED

NATIONAL SCHOOLS

LOS ANGELES 37, CALIFORNIA EST. 1905

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NATIONAL SCHOOLS, Dept. RN-5
4000 South Figueroa Street, Los Angeles 37, California

(Mail in envelope or paste on penny post card)

Mail me FREE the two books mentioned in your ad, including a sample lesson of your course. I understand no salesman will call on me.

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ADDRESS .....

CITY ..... ZONE ..... STATE .....

.... Check here if Veteran of World War II

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"We would never try to operate a radio servicing business without a complete set of Rider Manuals, for we service sets of all makes and ages, must have all the data at hand to locate quickly troubles in all receivers. That's why we always order the latest volume as soon as it's published"

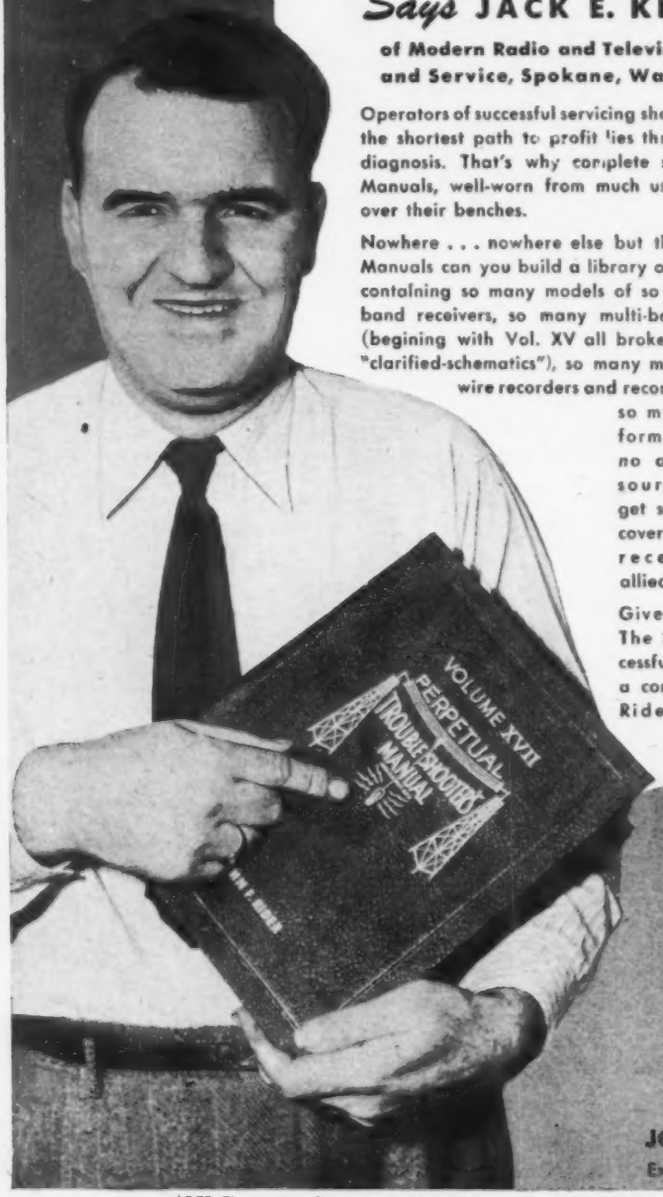
Says JACK E. KENNEY

of Modern Radio and Television Sales and Service, Spokane, Washington

Operators of successful servicing shops know that the shortest path to profit lies through speedy diagnosis. That's why complete sets of Rider Manuals, well-worn from much use, are found over their benches.

Nowhere . . . nowhere else but through Rider Manuals can you build a library of circuit data containing so many models of so many single-band receivers, so many multi-band receivers (begining with Vol. XV all broken down into "clarified-schematics"), so many manufacturers, wire recorders and record players . . . so much vital information. From *no other* single source can you get such complete coverage of U. S. receivers and allied equipment.

Give *Your* shop The Sign of Successful Servicing . . . a complete set of Rider Manuals.



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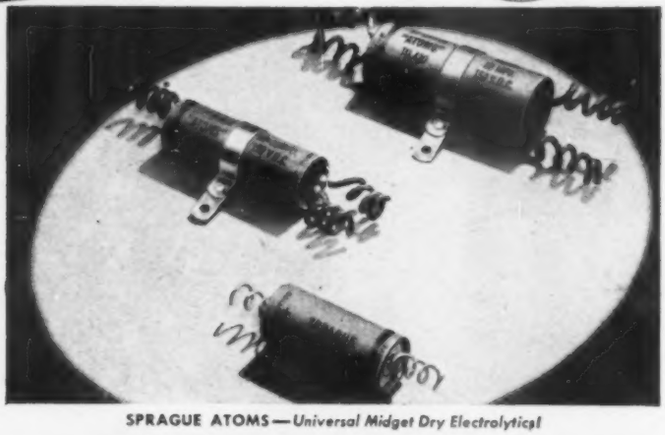
GENERAL ELECTRIC
Electronic TUBE
MADE IN U.S.A.
GENERAL ELECTRIC
FIRST AND GREATEST NAME IN ELECTRONICS

Why play "PENNY-ANTE"... when your business is at stake?

A good reputation, like good-will, is built by many deeds, but may be destroyed by a single dissatisfied customer. Your reputation is too valuable to risk for the few pennies "saved" by buying inferior or unknown "bargains." That's why we keep repeating *"Your Reputation and your customers deserve the best!"* And the best means Sprague.

SPRAGUE TM TUBULARS—*The first truly practical MOLDED Paper Tubular Capacitors!*



SPRAGUE ATOMS—*Universal Midget Dry Electrolytics!*

SPRAGUE LM—*Universal Mounting Replacements!*

SPRAGUE EL—*Self-Mounting Midget Can Type!*

THESE SPRAGUE PRODUCTS ARE UNCONDITIONALLY GUARANTEED!

When used at their capacitance and voltage ratings, these Sprague Products are unconditionally guaranteed to render satisfactory performance.

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*KOOLOHM RESISTORS

SPRAGUE

*T.M. Reg. U.S. Pat. Off.

SPRAGUE PRODUCTS COMPANY, North Adams, Mass.

(JOBBING AND DISTRIBUTING ORGANIZATION FOR THE PRODUCTS OF THE SPRAGUE ELECTRIC COMPANY)

RADIO SERVICEMEN! 19 PRIZES FOR 18 IDEAS

HERE'S HOW EASY IT IS TO WIN

Right now, you may have a winning idea at work in your shop. An idea for a simple service tool which makes your work easier, faster, more profitable. Hytron wants to help make such needed tools available to all servicemen — at cost. You can cash in on your idea easily — and also help the other fellow.

Simply obtain an official entry blank from your Hytron jobber — or write us. Answer a few simple questions on the blank. Then include a sketch with constructional details — or a photograph — or a model of your proposed tool. Mail to Hytron Contest Editor. The tool should be simple, practicable, durable, compact, easy and economical to manufacture. Examples: Hytron Tube Tapper and Miniature Pin Straightener.

That's all there is to it. Nothing to buy. Nothing difficult. No fancy writing. And could you use one of those beautiful deluxe test equipments — or one of those crisp new Savings Bonds! Check the easy rules. Get an official entry blank today for full details on how to win. Send in as many entries as you wish — in any or all six contests. Everyone wins a Tube Tapper. Your idea may hit the jackpot. Let's go!

HERE ARE THE EASY RULES

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WHERE . . . Mail to CONTEST EDITOR, HYTRON RADIO & ELECTRONICS CORP., SALEM, MASS.

WHEN . . . There are six monthly contests. Opening and closing dates for each contest are the first and last days of each of the months from May through October, 1948, inclusive. The postmark date determines month of entry. Entries for final month's contest must be postmarked before midnight, October 31, 1948, and received by November 15th. At judges' discretion, unsuccessful entries in any month's contest may be re-considered among following months' entries. You may subnit as many different ideas as you wish in any or all six monthly contests. Use separate blank for each entry.

PRIZES . . . See special listing of prizes.

JUDGES . . . Entries will be judged on originality, simplicity, practicability, durability, compactness, and ease and economy of manufacture. Judges will be: Sanford Cowan, Editor & Publisher of *Radio Service Dealer;* W. W. MacDonald, Managing Editor of *Electronics;* Oliver Read, Chief Editor of *Radio News;* Joseph Roche, Editor of *Radio Maintenance;* J. L. Stoutenburgh, Executive Editor of *Radio & Television Retailing;* Lewis Winner, Chief Editor of *Service.*

Judges' decisions final. Duplicate prizes in case of ties. No entries returned. Entries become property of Hytron, who may, at its option and by special arrangement with the entrant, pay the cost of a patent application (if the tool is patentable) with the understanding that Hytron is to have a non-exclusive license to manufacture, distribute, and sell the tool without royalties. Contests subject to all Federal and State regulations. Winners will be notified by mail. Grand prize winner will be announced in radio service trade papers shortly after close of final contest. Prize winner list available approximately one month after close of last contest.

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Hytron's Tube Tapper and Miniature Pin Straightener show you the kind of tool wanted. Check off the qualities. Simple? Yes. Practicable? Usable time-savers. Durable? Built to last. Compact? Carry them in your pocket. Easy and economical to manufacture? Adapted to mass production. Tube Tapper a nickel; Pin Straightener 49¢ — both under 50¢. Tools associated with tubes preferred, but other original service tools also acceptable.

HERE ARE THE PRIZES

First Prizes

MAY	DuMont Type 274 Five-Inch Oscillograph.
JUNE	Radio City Products Model 665-A, the "Billionaire", V-T Volt-Ohm-Capacity Meter, Insulation Tester; and Model 705-A Signal Generator.
JULY	Hickok Model 156A Indicating Traceometer.
AUG.	McMurdo Silver Model 900A "Vomax" Electronic Volt-Ohm-Milliammeter; Model 904 Condenser/Resistor Tester; and Model 905A "Sparx" Dynamic Signal Tracer/Test Speaker.
SEPT.	Jackson Model 641 Universal Signal Generator.
OCT.	Weston Model 769 High Frequency Electronic Analyzer.

Second Prize — Each Month $50 U. S. Savings Bond

Third Prize — Each Month $25 U. S. Savings Bond

Grand Prizes

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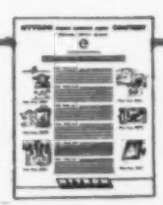
SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS



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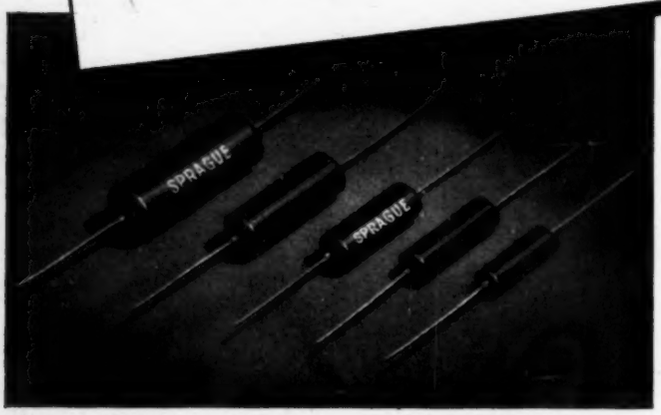

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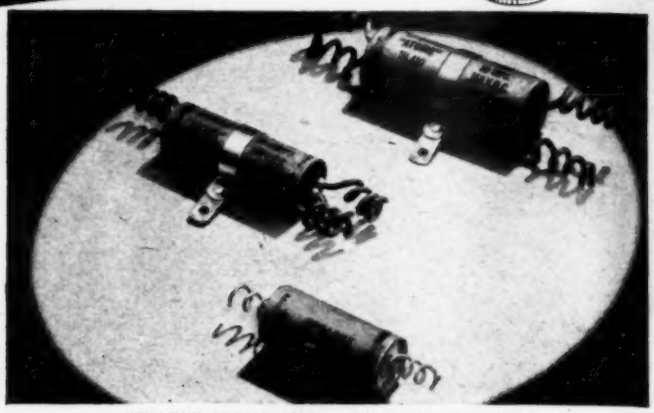

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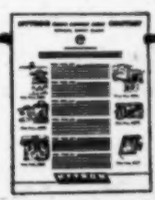
HYTRON



MAIN OFFICE: SALEM, MASSACHUSETTS

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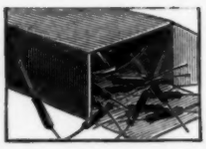

Provide ultimate stability. Temperature coefficient is determined by the ingredients of the ceramic di-electric; controllable to within very fine limiting values. Color coded. Flexible pigtail leads. Shpg. wt. 1 lb.

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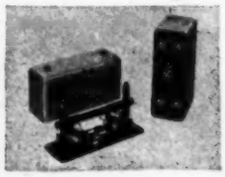

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Within the INDUSTRY

CAPTAIN DAVID R. HULL, U. S. Navy, (retired) has been appointed Assistant Technical Director of the *International Telephone and Telegraph Corporation.* Mr. Hull has been associated with the electronic research and radar development for the Navy during the past 23 years, the last two as Assistant Chief of the Bureau of Ships for Electronics.

Mr. Hull, who has been awarded the Legion of Merit and other military honors for his services during the war, has been engaged in radio and electronic research work since his graduation from the U. S. Naval Academy in 1925. As assistant Director of the Naval Research Laboratory at Washington, D. C., and later as head of the Design Branch and Deputy Director of Electronics of the Bureau of Ships he aided in perfecting the latest radar and electronic techniques for use by the U. S. Navy during the war.

* * *

SOLAR MANUFACTURING CORPORATION recently announced the appointment of Alfred S. Gartner as Assistant Sales Manager.

Mr. Gartner, who has been connected with the *Solar* organization for nearly five years, will devote his time to sales of capacitors and radio noise filters to equipment manufacturers in the radio and electrical industries.

* * *

JOHN W. CRAIG has been appointed General Manager of *Crosley Division, Avco Manufacturing Corp.* His new duties will include direction of all manufacturing and purchasing operations of *Crosley* and the *Carrollton Furniture Co.,* of Carrollton., Ky., an *Avco* subsidiary.

Mr. Craig is a graduate of the University of Dayton and holds a B.S. in mechanical engineering. He joined the *Crosley* organization in 1937 as assistant chief refrigeration engineer, later being promoted to chief engineer. Since 1945 he has been Works Manager of the *Crosley* Shelvador refrigeration plant in Richmond, Indiana.

During the war, Mr. Craig devoted his efforts to the development and improvement of the Mark 14 anti-aircraft gunsight.

* * *

THE EMPIRIA CORPORATION recently announced the visit of the Messrs. Shah of the *Terra Trading Company* of Bombay. The gentlemen are interested in the purchase of quantities of machinery for the production of plastic and other electrical accessories, radio, electronic and cinema equipment, and engineering materials.

They would like to contact manufacturers of such products and may be reached at the *Empiria Corporation,* 149 Broadway, New York 6, New York.

* * *

ALBERT J. ROSEBRAUGH has been appointed manager of small radio set sales for *Philco Corporation.* In his new capacity Mr. Rosebraugh will be responsible for nationwide sales of the *Philco* line of small radio sets through the company's distributor and dealer organization. Mr. Rosebraugh has held various positions in the company since he first joined *Philco* in 1928 and was employed in the service department of the company's Chicago wholesale organization.

* * *

PACKARD-BELL COMPANY of Los Angeles has announced three new appointments. William H. Cies has been named Sales Manager; Kenneth Johnson, Assistant Sales Manager; and Frank E. Ware, Field Sales Manager.

Before joining the *Packard-Bell* organization over a year ago, Mr. Cies was associated with *Booz, Allen and Hamilton,* Management Engineers, and *U. S. Steel Corporation.* Mr. Ware has been with *Packard-Bell* for the past nine years and has acted as Sales Manager since 1945. In his new capacity, Mr. Ware will spend the majority of his time in the field working with company distributors and dealers, and aiding dealers with their promotional work.

* * *

JOHN CLUNE, Sales Manager of *Air King Products Co., Inc.* and formerly sales manager of *National Union Radio Corporation's* Replacement Tube Division, passed away recently as the result of injuries sustained in an auto accident.

With Mr. Clune at the time of the accident was Russell Aiken, midwest

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12 D. C. Voltage Ranges on 4.4" scale. Mirrored for Accuracy. Special multipliers for permanent accuracy.

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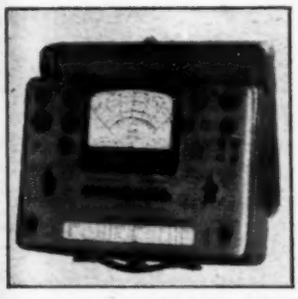
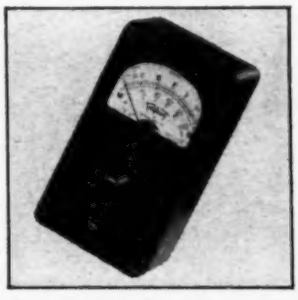
MODEL 625-NA

Dealer Net Price $45.00

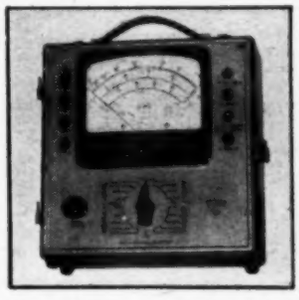
Solve your Service Problems Better—with TRIPLETT



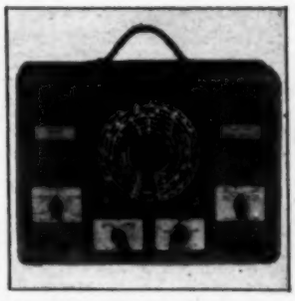
Model 3480—Combination Tube Tester and Volt-Ohm-Mil-Ammeter U.S.A. Dealer Net. $89.75



Model 666-HH—Pocket-size Volt-Ohm-Milliammeter. U.S.A. Dealer Net $22.00



Model 2405-A — Sensitive Volt-Ohm-Mil-Ammeter U.S.A. Dealer Net $54.75



Model 3432—Test Oscillator with illuminated dial. U.S.A. Dealer Net $63.25

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representative for *Air King* who is recovering from a broken neck received in the accident.

* * *

H. D. JOHNSON, formerly Assistant Sales Manager for *The Hickok Electrical Instrument Co.*, has been appointed Sales Manager, succeeding the late Robert Williams.

Connected with the radio and test instrument industry since 1928, Mr. Johnson received his initial experience as a "test man" in the radio receiver department of the *General Electric Company*. During the past war, he was in charge of Test Instruments for the War Production Board. Mr. Johnson also previously represented *Hickok* in the Philadelphia territory.

* * *

O. B. WILSON has been named industrial manager for the eastern sales region of the *Brown Instrument* division of the *Minneapolis-Honeywell Regulator Company*. Mr. Wilson's territory will include the New England States and northern Virginia.

He has been with the *Honeywell-Brown* organization for the past 25 years and has served as a sales engineer in various parts of the country. Mr. Wilson was formerly industrial manager in Houston, Chicago, and New York. His headquarters will continue to be in New York City, where he has been the *Brown* manager for the past two years.

* * *

LEOPOLD M. KAY, formerly Chief Engineer, has been promoted to the post of Vice-President in Charge of Engineering for *Air King Products Co., Inc.* Mr. Kay, who has been with the Brooklyn manufacturer of radios, combinations, and wire recorders for the past two years, held the position of research engineer for the *Raytheon Manufacturing Co.* before joining *Air King*. Prior to that he was in charge of wire recorder research for *Lear, Inc.*

Mr. Kay is a graduate of Lehigh and New York Universities and holds a B.A. degree in mathematics.

* * *

ALTEC SERVICE CORPORATION has announced the organization of a group of 250 special engineers to handle the emergency servicing of complex electronic devices now being used in every type of industry. These engineers are trained to handle electrical and mechanical engineering problems with preference given to mechanisms involving the principles and techniques of the vacuum tube which is usually outside

(Continued on page 184)

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The formula $I = \frac{E}{IRC}$ is a favorite and easily-remembered solution to resistance problems. Radio and electronic Engineers know that IRC offers the most complete line of resistance products in the industry . . . a fixed or variable resistor for most every requirement . . . with uniform dependability proved by years of rigorous laboratory and field tests. Purchasing Agents and material control executives like IRC's service . . . "on-time" deliveries . . . factory stock-piles of the most popular types and ranges from which they can draw in emergency . . . IRC's distributor network, providing speedy, 'round-the-corner service for small order requirements.

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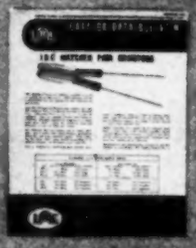

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POWER RHEOSTATS IRC types PR & PRT ☐

WATER-COOLED RESISTORS IRC type LP ☐

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Here's the portable your customers have always wanted! The new Westinghouse 185 is packed with all the features your salesmen need to make sales easier—exclusive Westinghouse Plenti-power for clear-as-a-bell tone, razor-sharp sensitivity . . . smart modern cabinet design, molded from beautiful *but tough* Burgundy-and-white plastic . . . plus a modest price customers can afford to pay. Pep up summer sales with this pint-size portable powerhouse, and let it pile up profits for you!

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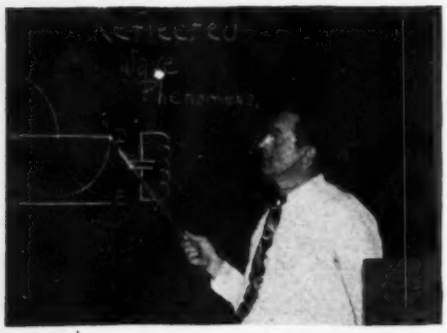

Mr. Albert C. W. Saunders' background includes association with the Marconi Company, teaching experience at Harvard and M.I.T.; founder Radio Technician's Guild; full member I.R.E.: Graduate, Portsmouth College, England. Mr. Saunders gave the first actual television demonstration in New England in 1935.

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NOW! AT NO EXTRA COST TO YOU—you can have the nationally-famous $500 Saunders' Television Course! It's the world's finest training—*practical* down-to-earth training that actually prepares you for Television and keeps you 'way out ahead of the game. Here's the *first real help* in Television for Servicemen—brought to you *exclusively* by PHOTOFACT and PHOTOFACT alone! If you want to stay in Radio Servicing, you can't afford to miss a single installment of this amazing Television Course! Read every word of this announcement and then ACT!

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We have been able to prevail upon Mr. Saunders to transcribe his famous course on Television for PHOTOFACT *exclusively*. The only other way you can get this course is by paying $500 and attending the Saunders School. *Now*—with PHOTOFACT at no extra cost to you—you can have this wonderful instruction that fits you for Television servicing!

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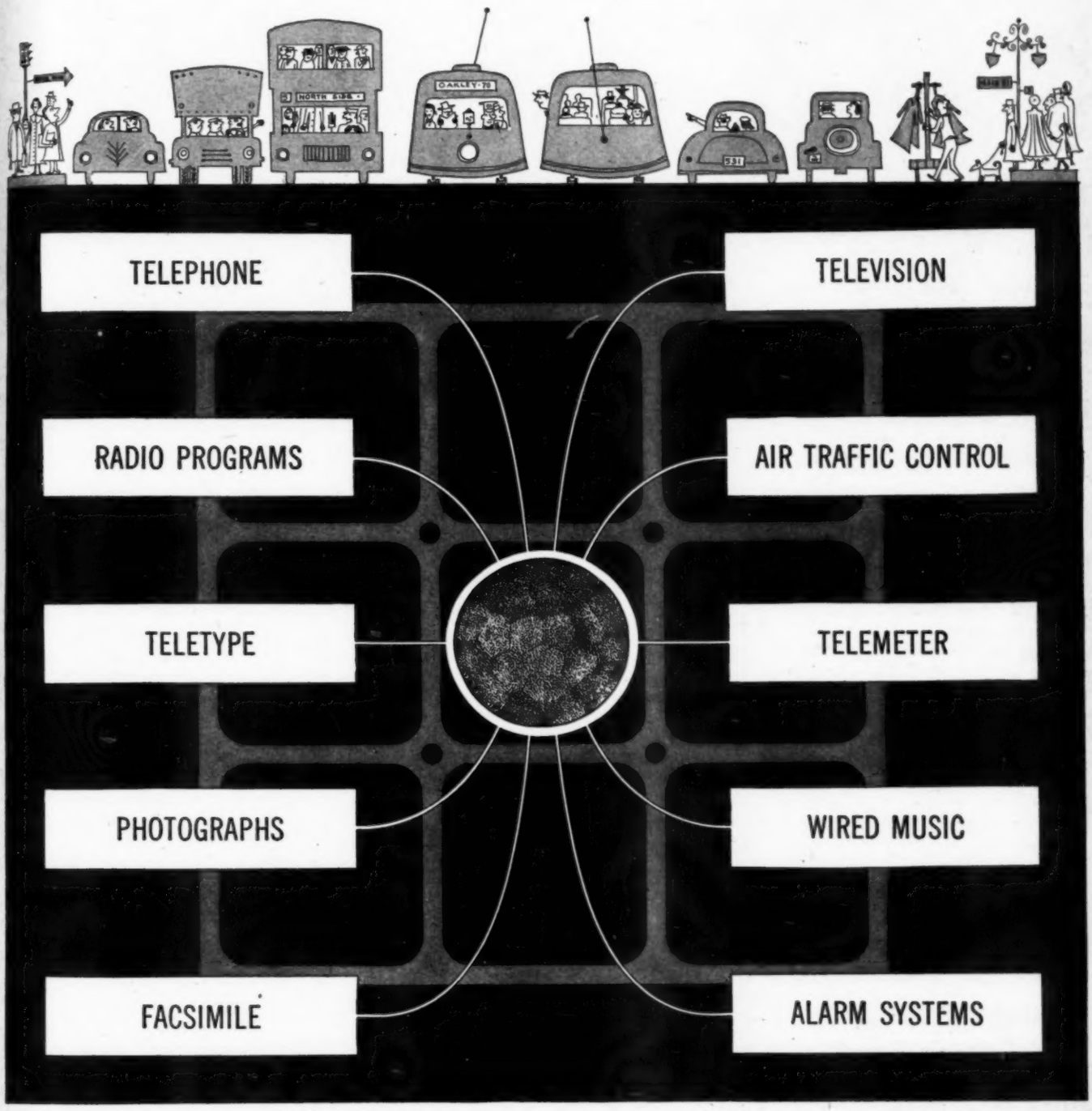

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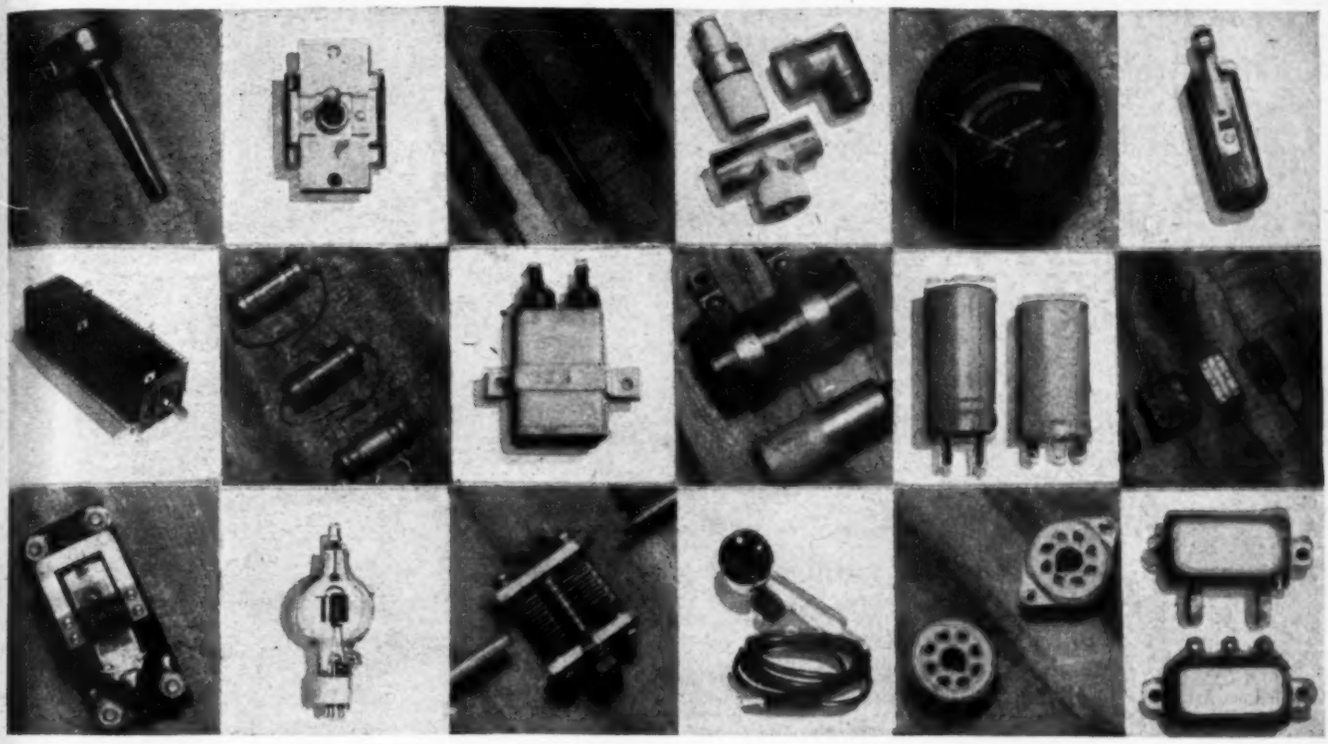

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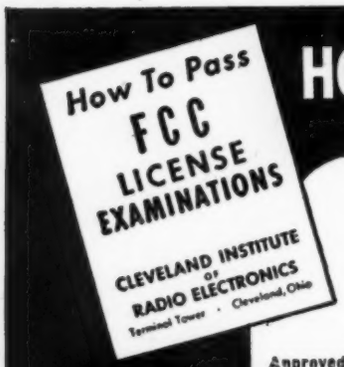

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Two-Way MOBILE RADIO— a new field for Servicemen

By LEO G. SANDS

Bendix Radio Division, Bendix Aviation Corp.

A review of the techniques and equipment needed to service all types of v.h.f. radio equipment.

DUE to the rapid expansion of the use of two-way radio in the mobile services, a new field has been opened to the enterprising and progressive radio technician, particularly so since equipment for the 152 to 162 megacycle band has become available in large quantities.

The taxicab industry has shown a tremendous interest in two-way radio. Thousands of taxicabs throughout the country are already equipped with radio and thousands more will be so equipped in the next few months. So great has been the interest of the taxicab industry that more than a thousand taxicab companies have applied for construction permits from the Federal Communications Commission. The use of radio by taxicab operators has resulted in the elimination of countless dead miles and increased business brought about through better service to the public.

The nation's railroads are adopting radio to provide better communication in yard and terminal operations, from caboose-to-engine, wayside-to-train, train-to-train, and even point-to-point, to supplement existing landline communications. Many of the railroads have hired radio technicians to maintain their radio equipment while others plan to farm out their radio work to private radio service organizations.

EDITOR'S NOTE: Most manufacturers of vehicular radio equipment are advising their customers that it is up to them to make arrangements for the servicing of that equipment with local servicemen. Technicians who have the proper equipment and "know-how" are in a position to augment their incomes impressively with this new type of maintenance work.

Very high frequency radio is being used for ship-to-shore communications in harbor operations by tugboat operators and shipyards. Municipal police and fire department radio services are gradually shifting from the 30 to 44 megacycle band to the 152-162 megacycle v. h. f. band. Power companies and other utility services are employing v. h. f. radio to dispatch service vehicles. Ambulance operators are being licensed to use v. h. f. radio. The field is so great that the surface has barely been scratched.

Radio dispatching service is being offered in many cities under limited common carrier licenses. These operators either sell or lease mobile radio units to their subscribers or in some cases, the subscriber buys his own mobile equipment. This type of service differs from the telephone company's urban mobile telephone service in that the subscriber can talk only to the dispatch land station and does not tie in with the regular telephone system.

In the future, a very large field will be open to the radio technician, the Citizen's Radio Service. Equipment for this service is not yet available, but when it is, the response by the public should be tremendous.

There is a crying need for skilled radio technicians to install and maintain two-way radio equipment for the many users of radio. In spite of the large number of well equipped radio service organizations manned by skilled technicians, too few of these organizations have the facilities to handle the maintenance of two-way radio equipment. An opportunity exists for the progressive radio service organization to get into the two-way radio field where a continuous and worth-while income is to be had.

To get into the two-way radio field, it will be necessary for all technicians to hold either first or second class radio telephone operator's licenses, if they are to make adjustments to radio

This dispatcher at High Point, North Carolina routes Bluebird cabs quickly and efficiently with radio. The company estimates savings up to 20 per-cent have been effected by eliminating dead-mileage and savings in gas, oil, etc.

transmitters. Furthermore, these technicians will have to familiarize themselves thoroughly with the characteristics of radio at the very high frequencies.

Test equipment for two-way radio maintenance must be of higher quality and more accurately calibrated than the equipment normally used for servicing broadcast receivers. The equipment needed will include:

1. Signal generator covering v. h. f. bands.
2. Signal generator for i. f. alignment.
3. Field strength meter.
4. Vacuum tube voltmeter.
5. Tube tester.
6. Test jigs.
7. Frequency measuring equipment to cover necessary bands.

The 152 to 162 megacycle band is the most widely used of the v. h. f. bands. A signal generator covering this frequency range, with or without frequency modulation, is an essential piece of equipment. In selecting a signal generator, one of the requirements is low signal leakage. If the attenuator or shielded case leak excessively, the signal generator will be useless for sensitivity measurements.

For i. f. alignment, a signal generator covering from about 1 to 30 megacycles is required. A high degree of frequency calibration accuracy is essential unless some sort of accurate measuring device is available for checking the signal generator's output frequency. A crystal controlled signal generator is ideal or a war-surplus BC-221 frequency meter may be used as a signal generator for this purpose.

For tuning and checking performance of mobile and land station transmitters, some sort of field strength measuring device is useful. A crystal detector and microammeter attached to a dipole is quite adequate. A v. h. f. receiver may be used as a field strength meter by measuring limiter or a. v. c. voltage.

A vacuum tube voltmeter is an indispensable instrument for servicing v. h. f. equipment, particularly for i. f. and discriminator alignment. Battery operation of the meter is desirable so mobile units, when necessary, can be serviced in a vehicle. Normally, adjustments requiring a vacuum tube voltmeter should be performed on the bench.

Testing of tubes to be used in v. h. f. equipments cannot always be done with an average or even better-than-average tube tester. Substitution methods are often required unless the technician possesses a truly adequate laboratory-type tube analyzer. However, a tube tester is a time saver in rejecting really poor tubes and the tester should provide means for checking all of the new miniature types as well as many low power transmitting tubes.

To handle servicing of many mobile units of the same type, the technician should equip his shop with test jigs that will permit operation of the unit on the bench even if partially disassembled. Usually, the manufacturer of the equipment will be happy to provide information on the fabrication of test jigs for his own equipment.

Under existing FCC regulations, every radio station must have its frequency checked at regular intervals. Usually, in the urban mobile services, a frequency check is made at least once every six months. Some users of two-way radio have purchased frequency monitoring devices which will give a continuous check on carrier frequency and frequency deviation. However, the monitoring device must itself be checked against an accepted standard.

A secondary frequency standard is an expensive piece of equipment, and very few shops can afford to own one. In its stead, a frequency monitor with switch selection of desired frequencies, or a continuously tunable heterodyne type frequency meter is often used. These devices should be checked with a secondary standard which in turn is usually checked against the Bureau of Standards station WWV. Absorption type wavemeters or lecher wire

The two-way radio telephone handset is within easy reach of the driver. The "Instant Call" feature keeps unwanted noise from the loudspeaker. Only a short tone preceding the conversation is audible throughout the cab. After the driver answers the call, conversation between him and the dispatcher is localized to the receiver of the handset. Cab customers are not annoyed by the loudspeaker noises.

are totally unsuitable for frequency measurement in this type of service.

Experimental taxicab radio stations are required to maintain a transmitter frequency stability of 0.01%, whereas regularly licensed services above 100 megacycles are required to stay within 0.005% of their assigned frequency. This means that equipment used to measure frequencies should be accurate to at least 0.0025%. Lecher wires can usually be used to measure frequencies to within 1%, which is not anywhere near close enough.

Radio services in the 152 to 162 megacycle band employ land station transmitters with power outputs ranging from 2 to 250 watts. Power is not a measuring stick for range at v. h. f. Quite often a 10 watt station can be heard as far as a 250 watt station. The higher powered station does provide greater field strength within its service area, but at the risk of causing interference to other services. For example, a spurious emission from a 250 watt station can be considerably more annoying than a spurious emission from a 10 watt transmitter.

When coverage of the metropolitan area of a large city is required, and one 10 to 50 watt transmitter will not provide adequate coverage, one 250 watt transmitter is sometimes employed. An alternate method is to employ two or more strategically located 10 watt transmitters on the same frequency. Generally this method provides greater coverage than is obtainable with one high powered transmitter.

In two-way radio, you must be able to receive as far as you can transmit. Generally, the land station transmitter and receiver are at the same location, and employ the same antenna. Under these circumstances, a high power transmitter has very little to offer, as the associated receiver must be able to pick up signals from mobile units of relatively low power.

For large area coverage, a high power transmitter may be used with reception from the mobile units through one or more strategically located receivers connected to the control office through landlines. On the other hand, two or more lower powered transmitters may be used with a receiver at each transmitter location and all controlled from one point.

The average land station installation consists of a transmitter, receiver, and power supply, located on the roof of a tall building, or hill top, remotely controlled from a central office by means of a leased telephone line. Where the control office is situated at a good radio location, the equipment is located in the same building and the antenna is mounted on a tall pole or tower. Generally, a 65 to 85 foot unguyed telephone pole will serve as an excellent antenna mast. Steel towers, guyed or unguyed, are readily available and are widely used.

As the range of v. h. f. radio is considered to be roughly line-of-sight, the height of the land station is the most important factor in governing communications range. Excellent communication between buildings, under bridges, and even through short tunnels, is often provided in the service area of a v. h. f. system due to the reflection characteristics of v. h. f. radio signals.

Taxi driver demonstrates the small size of two-way radio telephone units. The entire unit occupies little space in trunk compartment. Note antenna stub atop cab.

A good antenna at the land station is desirable. Many types of antenna are available, some that will afford a power gain of as much as 3.5 db. over a dipole and yet are non-directional in a horizontal plane. Vertical polarization is most commonly used in the mobile services, although experiments have proved horizontal polarization to be quite effective. Circular polarization has merit too, and is a combination of horizontal and vertical polarization.

Land station receivers are, in nearly all cases, of the crystal controlled superheterodyne type. They differ among manufacturers in circuit details. Both double and single superheterodyne circuits are widely used. One manufacturer employs a unique single superheterodyne circuit wherein the intermediate frequency is doubled in one of the limiter stages without using a second converter stage. This arrangement permits greater amplification and selectivity

(Continued on page 177)

Radio serviceman uses crystal frequency indicator to check transmitter frequencies. The most used items of test equipment for v.h.f. two-way radio installations include an r.f. signal generator, variable audio oscillator, set of absorption-type wavemeters, sensitive volt-ohm-milliammeter, secondary frequency standard, tube tester (preferably of the dynamic mutual conductance type), and a crystal frequency indicator. The latter item is a "must" since the FCC insists on "on the beam" accuracy. Also required are test harnesses designed to incorporate a voltmeter and milliammeter to give continuous indications of input voltages and current during servicing.

Portable Radios FOR RENT

By MAX ALTH

A good time for the vacationer can mean a big time financially for your radio shop. Why not try this money-making scheme this summer in your home town.

IF SPRING comes, can Summer be far behind? This paraphrasing of the well-known line from the poet means that soon it will be time for thinking of vacations and all forms of outdoor sports. Radio is closely linked to all forms of recreation—canoeing, sunbathing, picnicking, beach partying, etc.

For every person with a portable radio for such occasions there must be hundreds who say, "Gee, I wish I had a portable!" plus many hundreds more who exclaim, "Gee, I wish I had the money for a portable!"

Last summer Mr. Wolf of Brighton Beach, New York decided to do something about the natural affinity between radio and recreation. He hung a small sign over a card table placed in front of his store on Coney Island Avenue—the sign read "Portable Radios for Rent." All during the summer months there wasn't a sunny day during which he failed to rent every one of his portable radios at least once.

He charged thirty-five cents an hour rental with a $1.00 fee for the minimum of three hours.

Coney Island Avenue is only one of the many streets leading to the four mile beach that often draws more than a million bathers a day. All over the country there are hundreds of other streets and highways leading to local recreation spots. Your street might be one of these.

In addition to renting portables, Mr. Wolf has derived a steady profit from the sale of these units. Many of his customers rent portables out of curiosity—they have never heard one out-of-doors before. Since it provides them with so much pleasure—especially the ball fans who love to bury their heads in the sand and listen to the game—they make excellent prospects for the purchase of portable receivers.

Last year Mr. Wolf had to go easy on the set sales as new stock was hard to get. This year, with plenty of portables on the market, sales should provide an impressive part of the income derived from his beach business.

The sets being used for rental are the usual three-way receivers, covered in bright red or green imitation alligator and equipped with a shoulder strap. They list at $39.50. The words "Brighton Rental" appear in large black letters across the gold speaker grille to make the sets easy to identify.

Mr. Wolf operates his business from the sidewalk because he believes that summer beach business is carnival business and the right way to operate is out in the middle of the crowd.

He keeps four or five sets on the table beside him and the rest of his stock in the store behind him. He uses no advertising other than the sign over the table and the identification on the portables he rents out. When he first started the radio rental business he had some 8 x 10 two-color throwaways printed—and he threw them away—literally and figuratively because he received no returns that were directly traceable to the handbills. That finished that.

Mr. Wolf has an unparalleled trust in his fellow man. He hands a radio to anyone who gives him a dollar and identifies himself by means of a driver's license, card, phone bill, etc.

Heaven is going to be filled with Brooklynites, because after six weeks of operation last summer, Mr. Wolf has yet to lose his first radio! Judging by the first six weeks, it is conceivable that the loss of radios by theft is going to be a negligible factor in the cost of running the radio rental business—in Brooklyn anyway.

True, most of us would feel a bit self-conscious walking the boards at, say, Atlantic City with a radio marked "Brighton Rental." It would be rather like punting a rowboat around Lake Onondaga marked "Property of Central Park, New York City."

Considering the other side of the coin called "faith," few people come to the beach with $39.50 in their swimming trunks. To ask for a deposit that would cover theft—or even a five spot—would be a healthy deterrent for at least 90 per-cent of the customers.

Likewise, if time were spent in securing more positive identification, it would slow business down to a crawl. It would take an estimated 15 minutes to sign up each customer or twenty-five hours to hand out 100 sets. Fifteen minutes per customer means that a potential renter standing fourth in line would have to wait forty-five minutes before he or she received the set. People in a hurry to get on the beach just won't spend the time in line. The "Honor System" that Mr. Wolf uses takes only a minute or two and it keeps things moving.

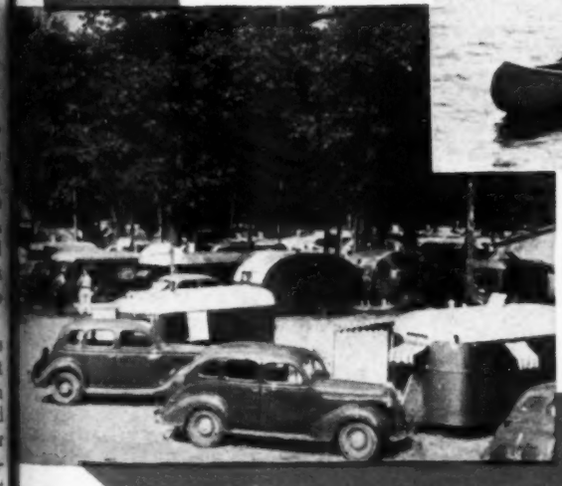
The cost of operating this business is quite low. Mr. Wolf figures on two flashlight batteries for every eight hours' operation and one "B" battery for every two-hundred hours. At eight cents per "A" and $1.50 for each "B," battery running time cost is approximately three cents an hour. This cost could, of course, be further reduced by using larger batteries.

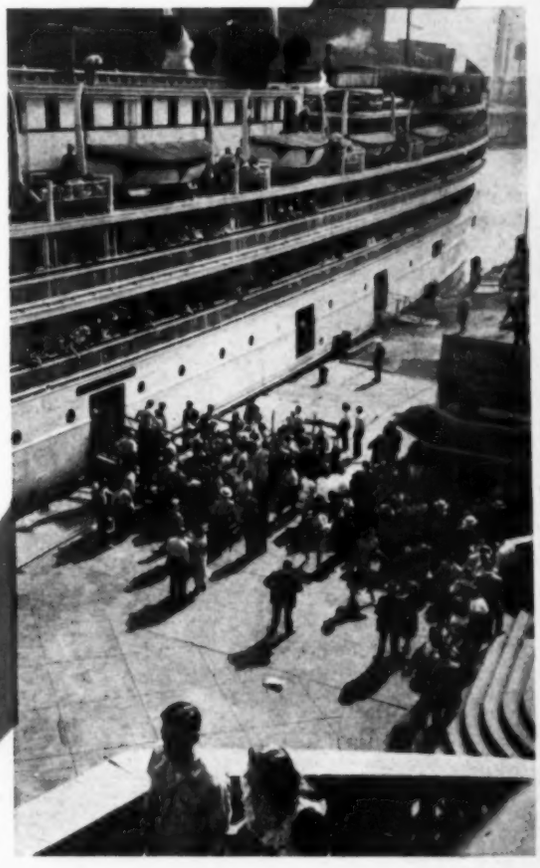
Since the sets used in the rental business are new they seldom break down but when they do it is usually just a tube gone west so Mr. Wolf doesn't find it necessary to maintain a servicing department. He sends the sets out for service when more than a tube is involved. He estimates that each set will cost him less than one dollar per year, on an average, for repairs, including lost knobs, torn straps, etc.

All in all, renting radios seems like a very good "pitch" for the serviceman. You don't even need a fast line of patter!

—30—

Location ideas—all recreational spots are potential sites for that profitable radio rental service.





A Crystal Diode Wave Shaper

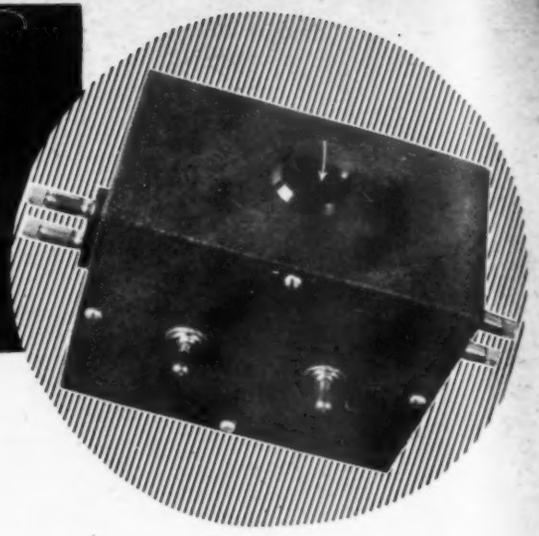


Fig. 1.

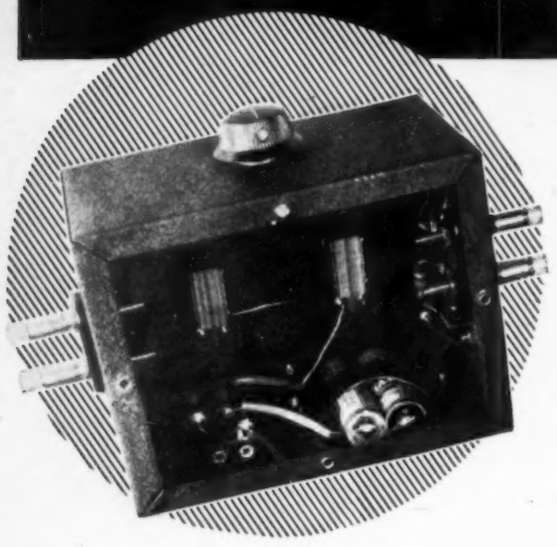


Fig. 2.

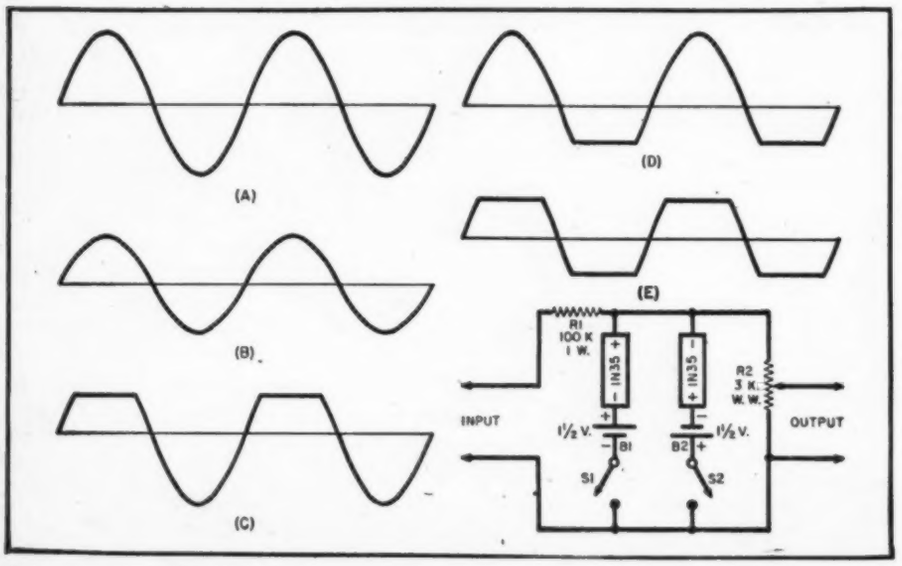
By
RUFUS P. TURNER, W1AY

This compact, tubeless test instrument will give square waves, positive pulses, or negative pulses from your audio oscillator.

A PAIR of germanium crystal diodes, a single 1 watt resistor, one wire-wound volume control-type potentiometer, two pen-size flashlight cells, two s.p.s.t. toggle switches, and two pairs of binding posts are the only parts required to build a simple, compact wave shaper. The results obtained with this little unit are good enough for most experimental purposes.

Operated from a sine wave input signal, this shaper may be employed in experimental work, testing, and classroom demonstration as a limiter or clipper and as a source of essentially positive pulses, negative pulses, or square waves. When it is connected to the output of an audio test oscillator, the shaper will deliver square waves of controllable amplitude at the oscillator frequency. Thus, square waves for amplifier testing may be obtained with a small-sized device employing no tubes. In the amateur radio station, the shaper will find use as a speech clipper, noise limiter for c. w. reception, and in a host of other applications requiring clipping of either positive or negative peaks, or both.

Fig. 3. Complete wiring diagram of crystal diode wave shaper. (A) A sine wave input; (B) sine wave output, S_1 and S_2 open; (C) pulses essentially negative, S_1 closed, S_2 open; (D) pulses essentially positive, S_1 open, S_2 closed; and (E) output essentially square wave, S_1 and S_2 closed.



Circuit

The complete circuit diagram of the shaper is given in Fig. 3. This will be recognized as the familiar diode "slicer" circuit, so arranged that both rectifier legs may be switched-in for true slicing (peak limiting of both positive and negative half-cycles of the sinewave input signal) or one leg at a time may be switched-in for either positive or negative peak limiting.

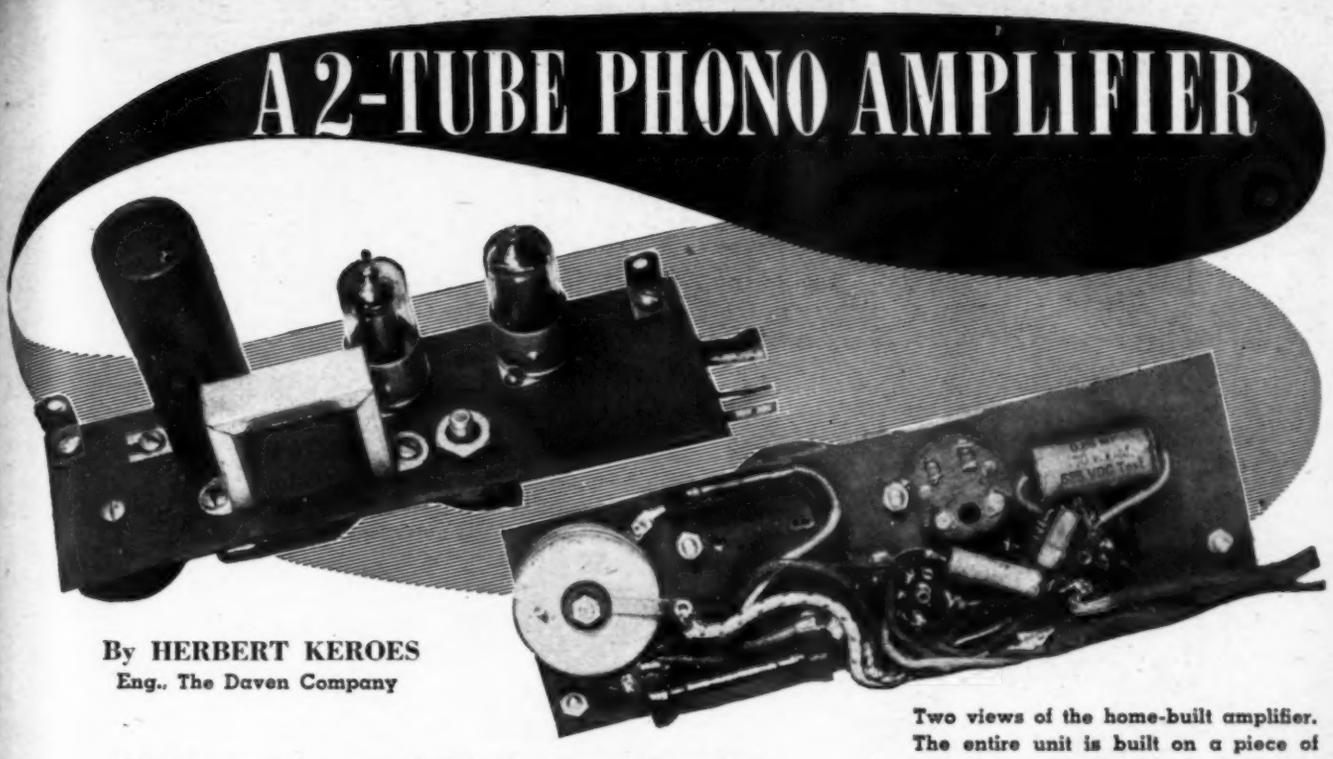
Operation of the device is simple. A sine wave signal (See Fig. 3A) is applied to the *"INPUT TERMINALS."* If both switches, S_1 and S_2, are opened, the sine wave is delivered at the *"OUTPUT TERMINALS"* (See Fig. 3B) and its amplitude may be adjusted by means of potentiometer R_2.

When switch S_1 only is closed, the positive half-cycles of the sine wave input voltage cannot rise to a value higher than the voltage of cell B_1. The positive peaks therefore level off at that voltage, but the negative half-cycles are free to increase to their maximum value. This results in the essentially negative output pulses shown in Fig. 3C.

When switch S_2 only is closed, the

(Continued on page 92)

A 2-TUBE PHONO AMPLIFIER



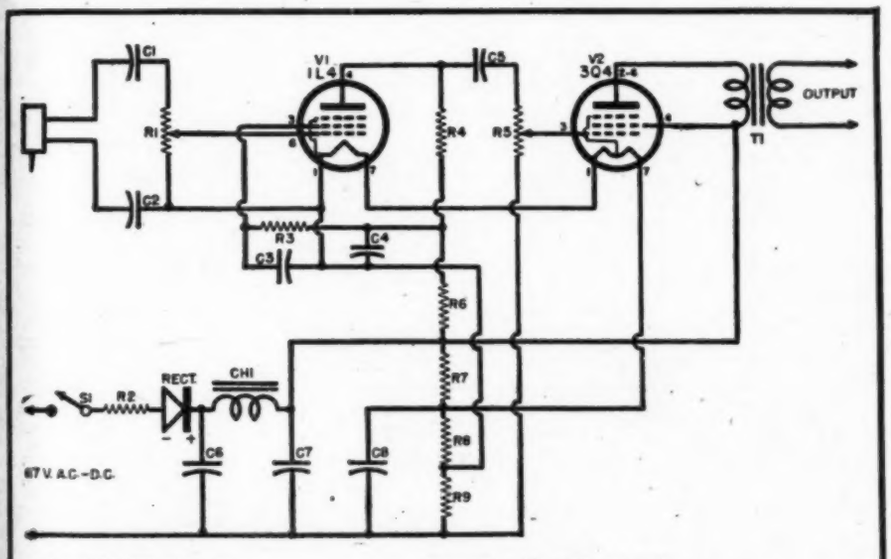
By HERBERT KEROES
Eng., The Daven Company

Two views of the home-built amplifier. The entire unit is built on a piece of bakelite measuring 2¼ by 6 inches.

A low output, easy-to-build phono amplifier that can be used with any standard type crystal pickup.

THE amplifier to be described was built primarily to convert a record player into a self-contained phonograph for a child's use. While the maximum output is not as great as that of the usual single beam power tube phono-amplifier, it is nevertheless entirely adequate to provide a good volume level in the average room. Several features have been included in the design that particularly suit the requirements of operation by a child.

Schematic diagram. Maximum power output is approximately 240 milliwatts.



R_1—250,000 ohm pot.
R_2—25 ohm, ½ w. res.
R_3—700,000 ohm, ½ w. res.
R_4—150,000 ohm, ½ w. res.
R_5—500,000 ohm pot.
R_6—50,000 ohm, ½ w. res.
R_7—1350 ohm, 5 w. res.
R_8—300 ohm, ½ w. res.
R_9—40 ohm, ½ w. res.
C_1, C_2, C_5—.02 mfd., 200 v. cond.
C_3—.01 mfd., 200 v. cond.
C_4—.25 mfd., 200 v. cond.
C_6, C_7, C_8—40/20/20 mfd., 200/200/20 v. elec. cond.
CH1—6 henry, 500 ohm filter choke or speaker field coil
T1—Output trans. 9000 ohm-to-v.c.
Rect.—100 ma. selenium rectifier
S1—S.p.s.t. sw.
V_1—1L4 tube
V_2—3Q4 tube
Speaker—Any size or type may be used (a 5" PM type is preferred)

The usual warm up period that takes place in conventional amplifiers using heater type tubes has been eliminated through the use of filament tubes and a selenium rectifier. The maximum volume level can be regulated in accordance with the wishes of the parent by means of an internally adjustable volume control. The usual external control has also been provided.

A stage of voltage amplification (see diagram) using a type 1L4 tube was included, since the average crystal cartridge does not develop sufficient voltage alone to drive the 3Q4 to full output. The d.c. filtering circuit is of the inductance-capacity type and provides an extremely low hum level. A speaker field winding may be substituted for the filter choke. It will be noticed that .02 μfd. condensers have been placed in series with each crystal pickup lead. This serves to prevent line voltage from being developed between the pickup arm and grounded objects in the room. In the diagram, the internally adjustable volume control is R_5 and the external control R_1.

The amplifier was constructed on a piece of bakelite 2¼" wide, 6" long, and 1/16" thick. The approximate location of the parts can be obtained by referring to the photographs. To further preclude the possibility of accidental shock, the amplifier was mounted within the cabinet with the back of the amplifier located closely adjacent to a side of the cabinet. Two angle clips,

(Continued on page 154)

An Inexpensive FM TUNER

By WILBERT T. PETERSON
Pioneer Electric & Research Corp.

Construction details for a low-cost FM tuner based on a relatively new circuit design.

SINCE the advent of frequency modulation, experimenters interested in the new art have been faced with the problem of constructing, at considerable cost, a high frequency superheterodyne incorporating r.f. and i.f. stages followed by either a limiter or two and a discriminator or a ratio detector to perform the function of noise elimination and detection. As a result, the experimenter has been reluctant to spend time and money building an FM tuner or receiver when, in many cases, he lacked the facilities for properly aligning the unit when it was completed.

In addition to the increasing popularity of FM broadcasting, a new circuit[1] has made its appearance, thus stimulating new interest in the medium. This circuit makes possible the construction of an inexpensive FM tuner in a single evening by even the most inexperienced constructor. Results compare favorably with tuners costing from five to ten times as much as the components used in this unit.

The circuit utilizes a dual high frequency triode with one section performing the function of a high frequency local oscillator, while the other section serves as a converter, i.f. amplifier, and superregenerative detector. In the design of this circuit the superregeneration takes place at the i.f. frequency of 21.75 mc., thus allowing the quenching action to be adjusted for optimum performance at a single frequency and eliminating the necessity for a separate quench amplitude control. This makes the operation of the detector circuit independent of antenna characteristics and reactance changes in tuning over the signal frequency band. The quench frequency is in the vicinity of 20 kc. with the waveform and amplitude determined by the resistor–condenser combination R_2C_{11}. The inherent noise rejecting features of the superregenerative detector have been retained in this circuit.

Fig. 1 shows the completed tuner, while Fig. 3 shows the bottom view with all parts and wiring in place.

The secret of the clean, professional-looking layout lies in the design of the 21.75 mc. i.f. coil assembly. All of the parts shown within the dotted lines (Fig. 2) are assembled within the shield can. The coil itself is close-wound with 12 turns of No. 30 enameled wire on a form having an o.d. of .400". This coil, L_6 in the circuit diagram, is tuned to a frequency of 21.75 mc. by means of its associated 20 $\mu\mu$fd. ceramic condensers (C_{12}, C_{13}) and a powdered iron core $\frac{3}{8}$" in diameter and $\frac{1}{2}$" long. The 2000 and 5000 $\mu\mu$fd. condensers (C_{11} and C_{15} respectively) associated with this coil are of the recently-announced "*Hi-K*" ceramic construction. Coil L_5, the cathode injection choke, is wound on a bakelite form $\frac{7}{32}$" in diameter. The coil consists of 100 turns of No. 36 enameled wire. There is no inductive relationship between L_5 and L_6 despite the fact that they are mounted within the same 1⅜" x 1⅜" x 2" shield can.

The antenna primary winding, L_1, is made of plastic insulated hookup wire and is comprised of one turn pushed between the turns of the secondary winding, L_2. The leads from this winding are twisted together and soldered directly to the antenna connection terminals on the rear of the chassis.

Windings L_2 and L_3 consist of three and four turns of No. 16 tinned copper wire respectively. The coils are self-supporting and spacewound to an i.d. of ½". The oscillator coil should be tapped 1 turn from ground end. The coils are adjusted for tracking by squeezing or spreading the turns as required. The grid choke coil, L_4, consists of 120 turns of No. 36 enameled wire on a 7/32 inch diameter form. The placement of coils L_1,L_2, L_3, and L_4, is clearly shown in the photograph of Fig. 3. Coils L_5 and L_6 are mounted within the i.f. can.

Coils L_2 and L_3 are soldered directly to the terminals of the two-gang 15 $\mu\mu$fd. variable condenser and the grounded end in each case is soldered to a terminal placed under the screw which holds the condenser in place.

Condenser C_5 can be a small 2 $\mu\mu$fd. ceramic unit or can, as shown in Fig. 3, be made up of two pieces of plastic insulated hookup wire twisted together for a distance of one inch and soldered into the circuit at the variable condenser terminals.

The balance of the wiring is straightforward in every respect. The location of all parts, especially those associated with the 14F8 dual triode, should follow the layout shown. The use of dummy tie lugs to mount C_7, C_{10}, R_3, and R_4 as well as one end of R_1 and the leads from C_{16} and C_{17}, adds to the neatness and rigidity of the wiring.

After construction has been completed and all wiring has been checked the unit is ready for test and adjustment. Before proceeding, it should be noted that the chassis is "hot" with respect to the line. Care must be exercised in connecting the unit to test equipment, amplifiers, and other equipment. It is recommended that .1 μfd. isolating condensers be placed between the audio output terminals and the amplifier or radio to which the tuner is connected. It will also be noted that the hum level can be lowered by polarizing the line plug for minimum hum. Isolating condensers should be placed in each of the output leads.

If the i.f. transformer assembly is factory-built it is already aligned for the operating frequency and little adjustment will be required. On the other hand, a homemade coil will require alignment. Feed a 21.75 mc. amplitude modulated signal into the 14F8 grid (terminal 8) and adjust the iron core for maximum output as indicated on an output meter connected across the output of the amplifier used with the tuner.

If a signal generator having a range extending to the high frequency end of the FM band is available, it should be connected to the antenna circuit through a 300 ohm resistor and the oscillator trimmer adjusted for maximum output. The low frequency end of the band is now checked and the coil turns may be squeezed or spread, as required, to make the range agree with the dial calibration. Squeezing the coil increases the range while spreading it decreases the range. After

Fig. 1. Over-all view of FM tuner. The unit is simple to build and does not require any special component parts. ←

1. "The FreModyne FM Detector", RADIO NEWS, February, 1948.

each coil adjustment it will be necessary to return to 108 mc. and readjust the trimmer, repeating this step as often as required. After the oscillator agrees with the dial calibrations, the r.f. coil should be adjusted in a similar manner, all the while observing maximum output indications. It will be found that a slight interlocking occurs in adjusting the r.f. coil and, as a result, the condenser should be rocked slightly during the adjusting process.

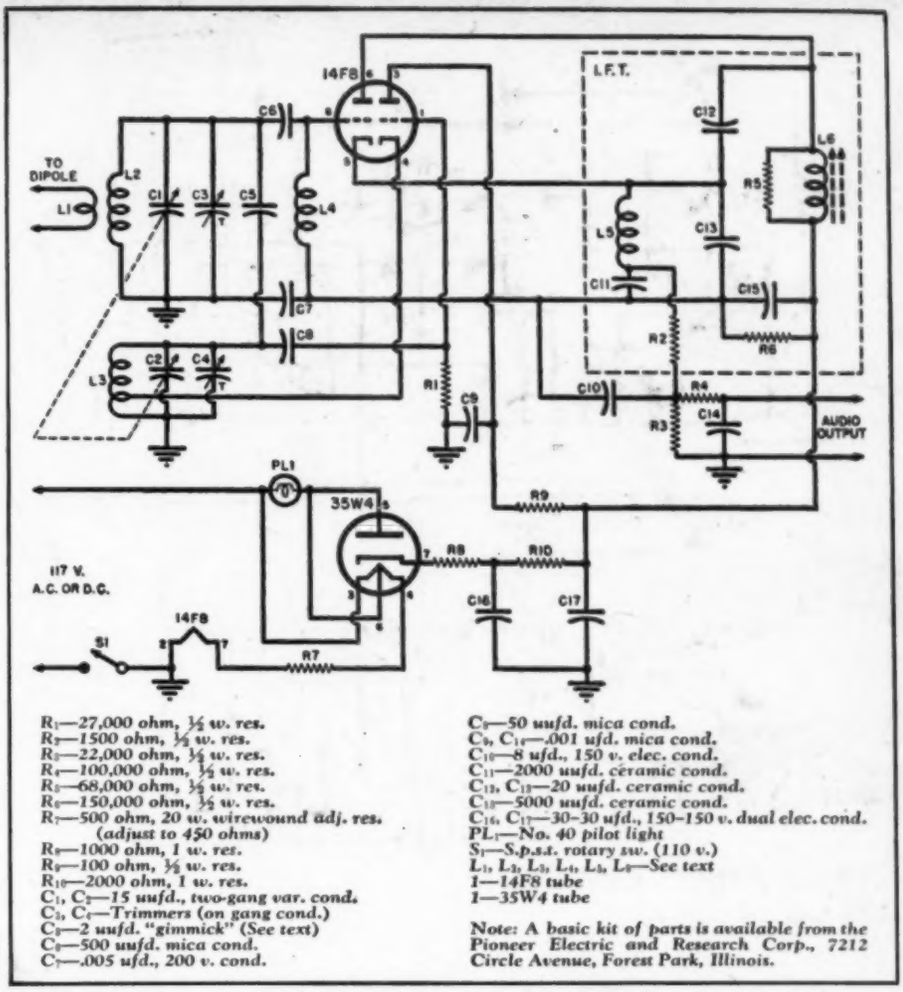
If a signal generator covering the FM band of 88–108 mc. is not available it is still possible to align the set properly by employing actual FM stations. In this case a good dipole antenna is an absolute necessity to assure reception from at least two stations—one near the high frequency end of the band, the other near the low frequency end.

The exact procedure is as follows; set the dial pointer so that its travel is an equal amount above and below the 88 and 108 mc. calibration points on the dial scale when the condenser is at its extreme maximum and minimum capacity. After setting the dial and carefully checking the wiring to make sure the converter is in operating condition a careful search of the band should be made to determine whether an FM station can be received. It may be necessary to also adjust the trimmer condenser mounted on the bottom of the gang condenser since this capacity is an appreciable part of the total circuit capacity and thus could prevent reception over the complete band. As soon as a station of known frequency is heard, the r.f. trimmer can be set for maximum signal intensity and a check made to determine if other stations can be received, adjusting the oscillator trimmer to bring the station in at approximately the correct dial reading. As soon as this is done other FM stations should be heard and we are now ready for the actual coil and trimmer adjustment.

The first circuit to be adjusted is the oscillator and this is accomplished by attempting to make the dial agree with the station frequency by means of the trimmer condenser, adjusting the trimmer while tuning to the highest frequency station received. If it is found that the dial indicates lower in frequency on a station tuned in near the low frequency end of the band, the oscillator coil is too low in inductance resulting in too small a range and the coil should be "squeezed" to increase the inductance. After each "squeeze" repeat the adjustment of the trimmer to the station on the high frequency end of the band. If, on the other hand, the station received near the low frequency end of the band comes in at high indicated frequency on the dial it is necessary to lower the coil inductance by "spreading" the turns until proper frequency coverage is obtained.

After the oscillator is made to agree with the range, the r.f. can be adjusted in the same manner for tracking with the oscillator. In this case the r.f. trimmer is adjusted to the high frequency station and a check is made to see whether the setting of the r.f. trimmer needs to be changed for the station received on the low frequency end of the band.

An outside dipole antenna should be rigged up for best reception especially in outlying districts where the receiving point may be at a relatively great distance from the FM transmitter. Although a superregenerative receiver has an inherent high sensitivity, the signal-to-noise ratio increases considerably on a weak carrier. Since slope detection is used, the signal will be found at two places



R_1—27,000 ohm, ½ w. res.
R_2—1500 ohm, ½ w. res.
R_3—22,000 ohm, ½ w. res.
R_4—100,000 ohm, ½ w. res.
R_5—68,000 ohm, ½ w. res.
R_6—150,000 ohm, ½ w. res.
R_7—500 ohm, 20 w. wirewound adj. res. (adjust to 450 ohms)
R_8—1000 ohm, 1 w. res.
R_9—100 ohm, ½ w. res.
R_{10}—2000 ohm, 1 w. res.
C_1, C_2—15 uufd., two-gang var. cond.
C_3, C_4—Trimmers (on gang cond.)
C_5—2 uufd. "gimmick" (See text)
C_6—500 uufd. mica cond.
C_7—.005 ufd., 200 v. cond.
C_8—50 uufd. mica cond.
C_9, C_{14}—.001 ufd. mica cond.
C_{10}—8 ufd., 150 v. elec. cond.
C_{11}—2000 uufd. ceramic cond.
C_{12}, C_{13}—20 uufd. ceramic cond.
C_{15}—5000 uufd. ceramic cond.
C_{16}, C_{17}—30-30 ufd., 150-150 v. dual elec. cond.
PL_1—No. 40 pilot light
S_1—S.p.s.t. rotary sw. (110 v.)
L_1, L_2, L_3, L_4, L_5, L_6—See text
1—14F8 tube
1—35W4 tube

Note: A basic kit of parts is available from the Pioneer Electric and Research Corp., 7212 Circle Avenue, Forest Park, Illinois.

Fig. 2. Complete schematic diagram of low-cost tuner. A dual high frequency triode is used in a superregenerative superheterodyne arrangement.

on the dial. Correct tuning is accomplished not at the point of maximum quieting but on either side, preferably toward the side removed from a possible interfering carrier.

The audio output obtained from this tuner is sufficient for its use in conjunction with a conventional table or console model receiver. A pair of high impedance headphones may be connected to the audio output and the tuner used as a complete receiver if desired. The audio fidelity, of course, cannot be expected to compare with that of the more complex FM receivers, but this tuner does bring FM reception within the range of the most meager budget in addition to providing even the novice experimenter with a simple and useful project.

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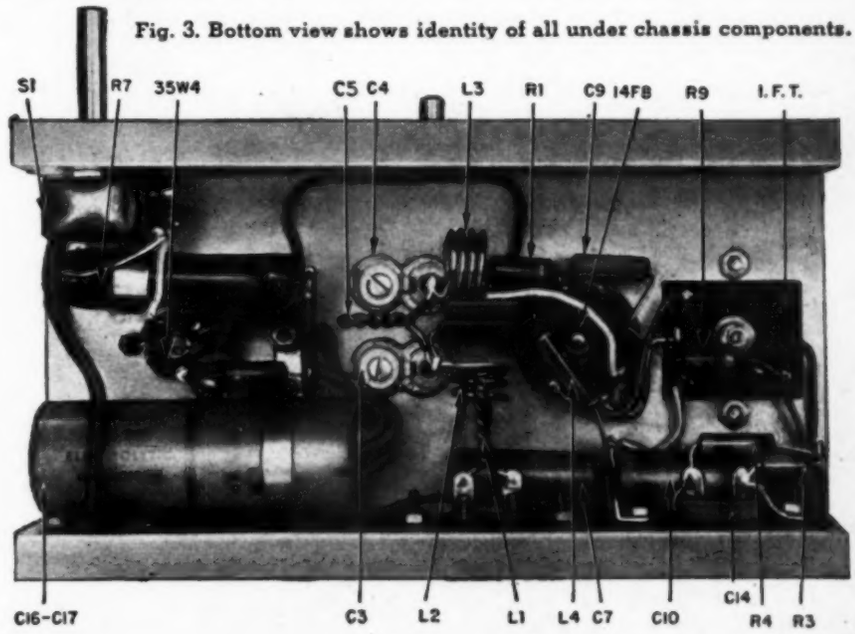


Fig. 3. Bottom view shows identity of all under chassis components.

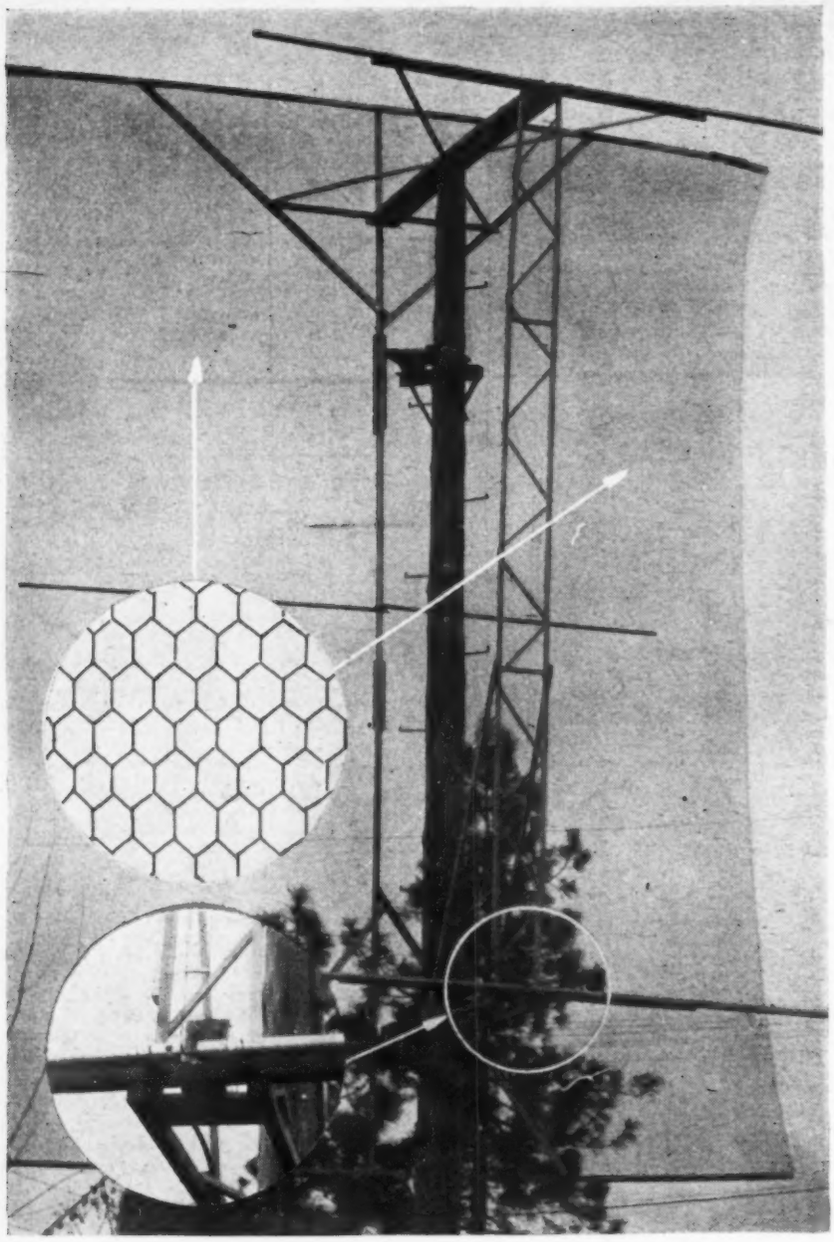


Fig. 1. Over-all view of antenna array. Ordinary chicken wire, as shown in the inset, is used for the reflector.

THE PIGEON CATCHER

By WES BELL, W7QR

A novel 29 mc. rotary beam—although massive it has a number of very desirable features.

THE "Pigeon Catcher" was so named by a local ham during an evening roundtable. His remarks were made after he had viewed the large wire screen reflector. This beam is patterned after the Signal Corps radar radiating system used to "shoot" the moon. The feed system however, is radically different. The Signal Corps SCR-270 radar antenna used 32 horizontal elements, 4 wide by 8 high, on frequencies near 100 mc. Such an array was out of the question on 28 mc. so we used only two elements. Basically the system described is nothing more than two half-waves in phase, stacked, backed up with a wire mesh reflector placed one quarter-wave behind the radiating elements. This is clearly shown in the picture, Fig. 1.

Such an arrangement has the following features:

1. A very low angle of radiation, necessary for DX
2. A very excellent front-to-back ratio. This helps reception.
3. Good gain.
4. Ease of feed. Will exactly match a popular ribbon.
5. Resonant over a broad band, permitting QSY without loss of transmitter loading or excessive standing wave ratio on the feeder.
6. Low cost.

Before going into mechanical details, it is best that we devote a few lines to some basic theory which will explain the "whys" and "wherefores" of construction. In Fig. 2 (left) is shown an end view of two half-wave dipoles, A and B, excited in phase. To an observer at point p or p^1, signals from the dipoles arriving at the same time add in phase so that addition results. At any other point, the signals will not arrive at the same instant, and will not be in phase. At any point on a line passing through both A and B, complete cancellation will result.

The vertical pattern of such a configuration is shown in Fig. 2 (center). If one radiating element is placed directly above the other and remote from ground, maximum radiation will take place along a line parallel with the earth. In other words, we will have a very low angle of radiation. This same principle is employed by those excellent performers, the Sterba Curtain and the Lazy H.

A wire screen reflector placed one quarter-wave behind the radiating elements makes the system unidirectional with a pattern somewhat like that shown in Fig. 2 (right). Due to the lack of a sky hook, the vertical pattern of the "Pigeon Catcher" has not been plotted. The actual size of the screen used is arbitrary. Sufficient size is necessary so that side lobes will not be present. A glance at Fig. 3 will show that the size actually used, 18 feet wide by 22½ feet high, is sufficient. This horizontal pattern was obtained by placing a thermogalvanometer in the center of a dipole placed about three wavelengths directly south of the beam. With enough power to cause the meter to read full scale (115 ma.) with the beam pointing towards it, radiation from the back and sides was so low that the pointer fell within the first division on the meter. Thermoammeters have cramped scales at the bottom and our meter had a wide pointer. It was therefore impossible to make accurate readings of the back and side lobes. It may be safely assumed that this beam has a front-to-back power ratio of 100 to 1 or 20 db.

Conventional dipoles, when used in

beam antennas, exhibit a very low impedance from the parasitic elements. This low impedance is not a desirable feature for several reasons. In the first place, a very low impedance is hard to match. Secondly, the losses are higher Power in a dipole is equal to the current squared multiplied by the resistance. This resistance comprises two parts; radiation resistance and loss resistance. These act as if in series. This may be stated as $Watts = I^2 (Rrad + Rloss)$. Assuming a power of 300 watts, it can be seen that I^2 equals 75 in the case of a 4 ohm antenna and equals 1 in a 300 ohm antenna. If *Rloss* is .1 ohm in each case, it follows that 7.5 watts will be wasted in a 4 ohm dipole against 1 watt in a 300 ohm system. This is an improvement of 75 to 1 or 18.75 db. *more* r.f. will be wasted in a low impedance dipole than in a high impedance one if we assume that the dielectric losses do not go up. If the feed point impedance is not made too high, there is no need to worry about this. Folded dipoles provide a means of raising the feed point impedance and may well be used with the arrangement described here How ever, we did something else to arrive at the same result.

Each dipole consists of two radiating sleeves of 2 inch o.d dural. Each sleeve is shorter than a quarter-wave and the two are placed end-to-end with a two inch space between. This is the same as plac ing the radiation resistance in series with a condenser. See Fig 4A

A section of ¼ inch copper tubing is inserted in each sleeve and shorted to the wall at a distance of 40 inches each side of center See Fig. 4B This 40 inch section of rigid coaxial line acts like an inductance, and the two in series (each side of center) make up an inductance that parallel resonates with the series combination of *C* and *Rr* By this means, the feed point impedance of the dipole is raised considerably The impedance of one of these dipoles placed at sawhorse height above ground, was measured and found to be 1160 ohms Paralleling a second dipole and adding a reflector brought the impedance down to 300 ohms. A perfect match for a popular cable!

A crossover is necessary in the line connecting the upper and lower dipoles, because a half-wave line reverses the phase, and we want the radiator to operate in phase. This line may be of any characteristic impedance because a half-wave line repeats the load. In other words, a resistance at one end is not changed in magnitude when viewed at the other end. We used #14 wire spaced two inches. This line is a full half-wave long ($Lft = 492/Fmc$.) and is not shortened to compensate for end effect as is done with antennas. The lengths shown are for 29 mc. The length of the inductive section for other frequencies can be computed from the following formula: $Linches = 1131/Fmc$. This is the length of inner conductor for *each* side. The gap between halves is not included. The length of the radiating sleeves is found

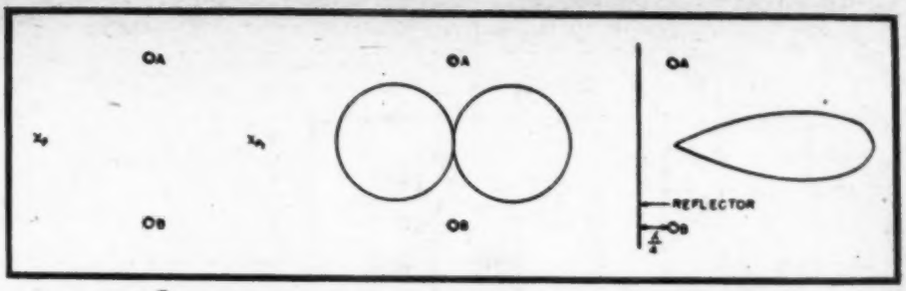


Fig. 2. (Left) Assuming that two half-wave dipoles, A and B, are excited in-phase, the signals emitted would arrive in-phase at points Xp and Xp1. (Center) Shows vertical pattern of antenna array (Right) Shows uni-directional pattern of antenna obtained with wire screen reflector placed one-quarter wave behind the radiating elements.

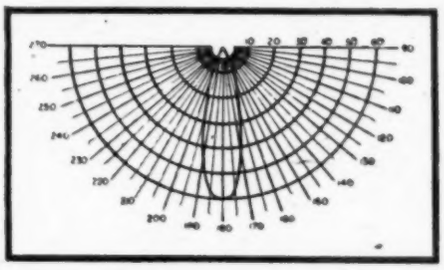


Fig. 3. Antenna field pattern at 29 mc. The dipoles were center-spaced with a current squared galvanometer indicator. Readings shown are proportional to the power

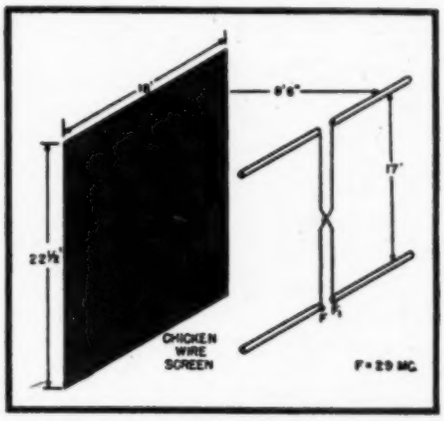


Fig. 5. Mechanical details of antenna.

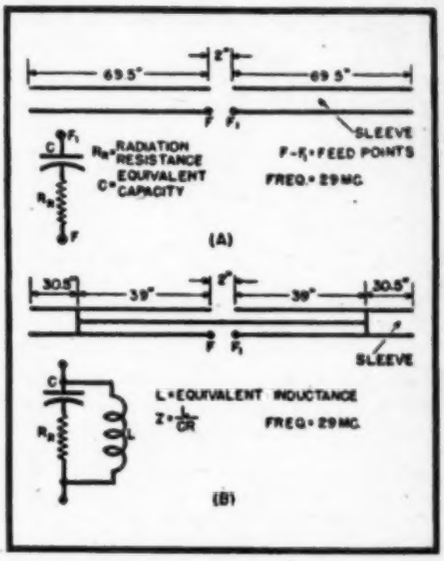
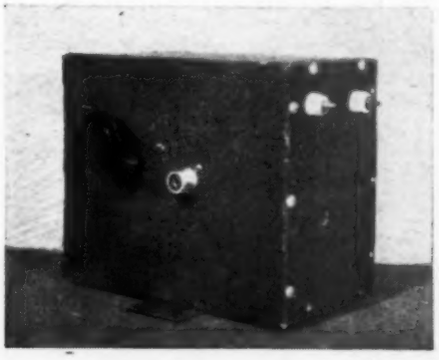


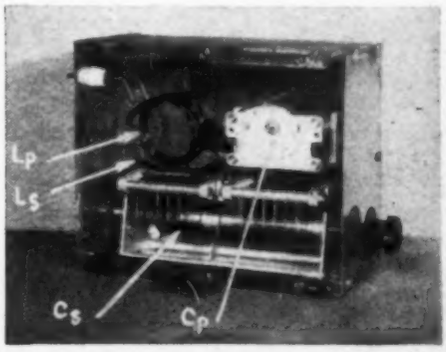
Fig. 4. Each dipole consists of two radiating sleeves which are placed end-to-end with a two inch space between. The effect, as shown by the equivalent circuit, is the same as placing the radiation resistance in series with a condenser. (B) A section of one-quarter inch copper tubing is inserted in each sleeve and shorted to the wall at a distance of 40 inches each side of center. As shown by the equivalent circuit, the entire assembly appears as an inductance in parallel with a series combination of resistance and capacity

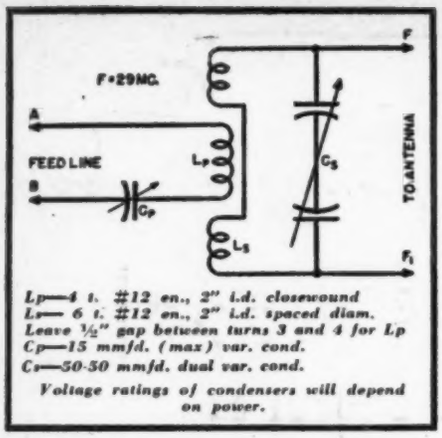
from $Linches = 2015.5/Fmc$ This is the length for each sleeve Two are required per dipole These formulas hold for 1⅞ inch i.d tubing only

The copper tubing is spaced inside the 2 inch dural tubing by means of lucite discs held in place by bushings obtained from worn out volume controls. The nut that originally held the control to the panel is used to hold the disc, and the bushings themselves are soldered to the tubing at about 12 inch intervals Some volume control cases are made of bakelite and a blow with a hammer will break the bushing loose. Warning Do not attempt to solder the bushing with the disc in place as lucite softens under heat. The shorting bar at each end of

Fig. 6. Front and rear views of coupling unit used in conjunction with antenna array.







Lp—4 t. #12 en., 2" i.d. closewound
Ls— 6 t. #12 en., 2" i.d. spaced diam. Leave ½" gap between turns 3 and 4 for Lp
Cp—15 mmfd. (max) var. cond.
Cs—50-50 mmfd. dual var. cond.
Voltage ratings of condensers will depend on power.

Fig. 7. Circuit diagram of coupler unit suitable for 1 kilowatt operation at 29 mc.

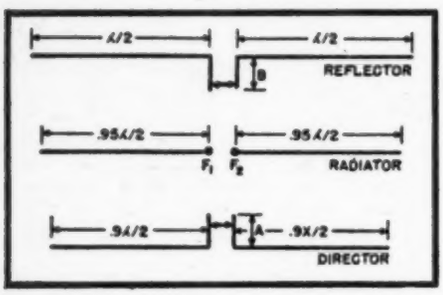


Fig. 8. Twin three-beam antenna array. Adjust sliding bars for maximum gain or best front-to-back ratio as you desire. Distance (A) from shorting bar to director will probably be somewhat less than a quarter wave. Distance (B) from shorting bar to reflector will be a little more than a quarter wave. A wide spacing between elements is generally preferred. Antenna coupler should be connected to the feed points, indicated as F1 and F2.

the inner conductor is made of phosphor bronze with bent lips that firmly bear against the inner surface of the radiating sleeve. These, too, are held in place with old volume control bushings. The dipoles themselves are supported from a 6 foot piece of 2 x 2 using two insulators each side of center. Full dimensions of all parts of the complete 29 mc. antenna are shown in Figs. 4B and 5. The reader is left to figure out his own framework and means of rotation. The screen support pictured used only 2 x 2 material and withstood some very heavy winds. However, every ham has his own ideas on the subject.

The Coupling Unit

The coupling unit used with the "Pigeon Catcher" has the following points in its favor:

1. Extreme ease of adjustment.
2. Low cost.
3. Simple to construct.
4. Will tune out reactance due to improper length of radiating elements.
5. Provides a means of connecting a balanced load to an unbalanced line.
6. Small in size and low in weight.
7. Will provide an *exact* impedance match between any line and any load of 300 or more ohms. (Can be modified to match a lower load impedance but design becomes difficult as will be seen.)
8. Provides a means for using the popular RG cables to feed rhombic, V, Lazy H, Sterba, Franklin, and similar beams.

A coupler unit suitable for a full kilowatt is shown in Fig. 6. The physical size and electrical ratings of components can be considerably reduced for use with low power. Circuit values are shown in Fig. 7.

This article is of the practical type, however those who are interested in the mathematics and theory will find the following data of value. In coupled circuits, the condition for maximum energy (impedance match) is expressed as. $Ko = 1/\sqrt{QpQs}$ where Ko is the coefficient of coupling, Qp is the "Q" or figure of merit of the primary circuit, and Qs the same for the secondary circuit. In our case the primary is a series resonant circuit with a "Q" equal to $1/wCR$. The larger the inductance and smaller the capacity, the higher the Q. The secondary of this coupler is a parallel resonant circuit with a Q numerically equal to wCR. The larger the capacity, the higher the "Q". Setting Cp to 5 mmfd. and Cs to 50 mmfd. with resistances of 72 and 300 ohms respectively, gives a required coefficient of coupling of .16. This value is easily obtained in practice.

From the foregoing, it can be seen that adjustment of the coupling between primary and secondary will provide a means of matching impedance. It is much simpler to slide a link in and out of a coil than to adjust a T-match or to cut and prune a quarter-wave matching section. Condensers are capable of more precise adjustment too, so that residual reactance will not cause trouble. It is *not* necessary to make any calculations to construct such a coupler or to put it into operation. The auxiliary equipment needed consists of a standing wave indicator and a low power source of r.f. energy. Your transmitter may provide the latter if you can reduce the coupling to the final sufficiently.

In most cases, a split stator condenser has been found necessary for Cs. A single ended condenser causes a slight unbalance and one terminal becomes "hotter" than the other. The effective Cs then is, of course, one half of the capacity-per-section. With power of up to 75 watts or so, ordinary receiver spacing is sufficient for both Cp and Cs.

To adjust this coupling unit, connect the antenna across Cs and the feed line in series with the primary. Insert the standing wave meter in the feed line, then adjust Cp and Cs for minimum standing wave ratio (SWR). If the SWR does not go down to almost 1, adjust the coupling between Lp and Ls. High antenna impedances will require less coupling than those of low impedance. If tighter coupling is indicated with the link (Lp) all the way in, it will be necessary to use smaller Cp and larger Lp, larger Cs and smaller Ls, or to tap down equal amounts from each end of Ls.

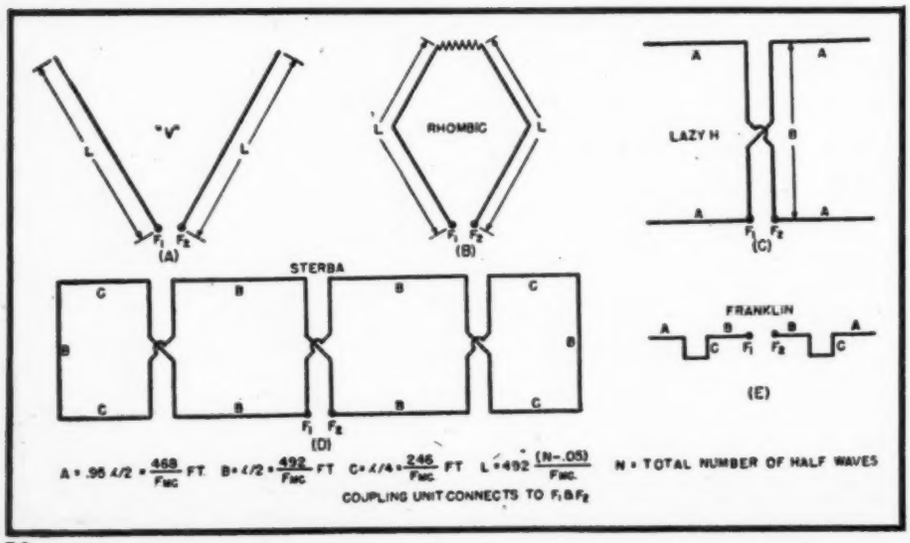
It is best to insert the SWR meter at the transmitter end of the feed line, because slight discontinuities introduced at the antenna end may give erroneous readings. In this case it will be necessary to keep one man at the transmitter end to read and relay the SWR readings while you adjust the coupler. Make certain that both primary and secondary circuits will tune to resonance before connecting the antenna. If the antenna is too long, less Cs will be needed; whereas if it is too short more Cs will be required. If minimum SWR is obtained with Cs fully in or out, adjust the length of the antenna elements accordingly.

With a flat line, your transmitter may not load as well as you feel it should. Flat lines require rather tight coupling at the transmitter end. It may even be necessary to resort to series or parallel tuning to the transmitter link. This is permissible and will not affect the SWR.

To feed rhombic, V, Sterba, Franklin, Lazy H, and similar systems, connect the coupler at a voltage loop near the center of the array. Suggested spots

(Continued on page 132)

Fig. 9. Preferred method of connecting coupler to various types of antenna arrays.



A Crystal Controlled Signal GENERATOR

Fig. 1. All adjustments are on front panel. The desired frequency is obtained by plugging proper crystal into the socket on the front panel.

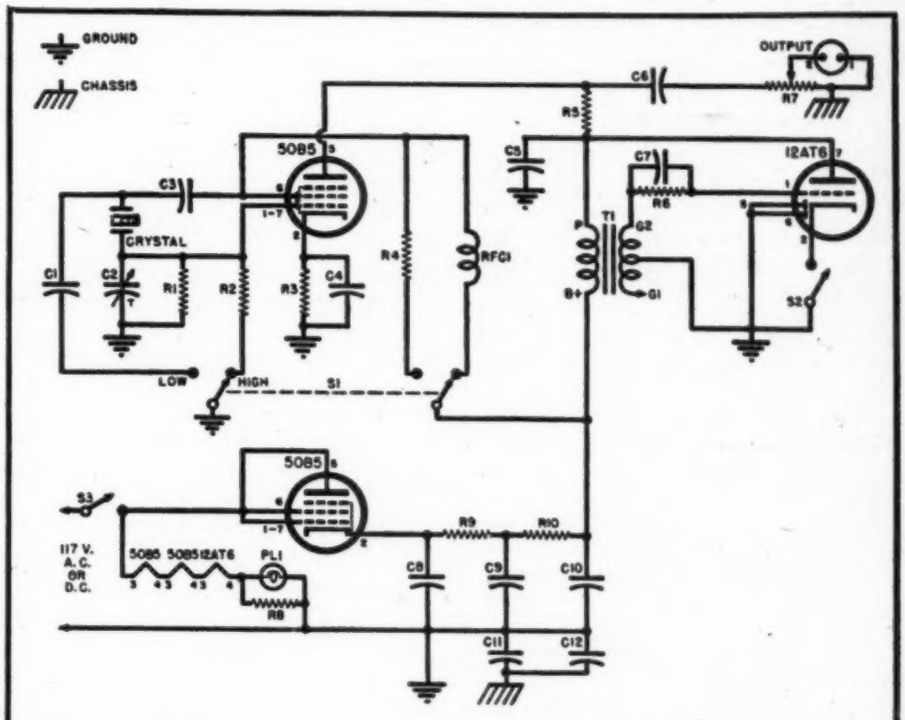
By J. BANN
Eng., Premier Crystal Laboratories, Inc.

Although commercially built, this generator can be easily duplicated at home or in the shop.

SEVERAL interesting features have been embodied in one newly developed quartz crystal controlled miniature signal generator. In addition to possessing the well-known precision characteristics and stability of quartz crystals the instrument is compact, portable, light weight, flexible in its applications, and extremely simple to operate.

The "Crystal Controlled Mini-Signal Generator" was developed by *Premier Crystal Laboratories, Inc.* of New York City. It may be used with crystals that can be plugged into a front panel socket for frequencies from 100 kc. up to well over 12 mc. Harmonics of these frequencies are useful into the v.h.f. region. No tuning is required to set the oscillator up at any frequency for which a crystal is available. A panel adjustment is provided to make small frequency corrections when the generator is used as a standard of frequency. The standard 100 kc. crystal supplied with the unit can be adjusted in this way to zero beat at the crystal fundamental or any harmonic with standard frequency transmissions of WWV or a secondary standard of frequency. This enables the operator to use the crystal harmonics as standard frequency markers throughout the radio spectrum (up to 30 mc.), with sensitive detecting equipment. If the same results are desired at higher frequencies (up to the upper limits of the television bands) this can be achieved by the use of crystals at a higher fundamental fre-

(Continued on page 180)



R_1—*1 megohm, ½ w. res.*
R_2—*30,000 ohm, ½ w. res.*
R_3—*3900 ohm, ½ w. res.*
R_4, R_5—*100,000 ohm, ½ w. res.*
R_6—*30,000 ohm, ½ w. res.*
R_7—*25,000 ohm wirewound pot.*
R_8—*39 ohm, 2 w. res.*
R_9, R_{10}—*1000 ohm, 1 w. res.*
C_1—*150 μμfd. mica cond.*
C_2—*50 μμfd. air trimmer (Hammarlund APC-50 or equivalent)*
C_3, C_8—*.01 μfd. mica cond.*
C_4—*.005 μfd. mica cond.*
C_5—*.02 μfd., 400 v. cond.*
C_7—*.00025 μfd. mica cond.*
C_8, C_9, C_{10}—*30 μfd., 150 v. elec. cond.*
C_{11}, C_{12}—*.05 μfd., 400 v. cond.*
RFC_1—*2.5 mh. r.f. choke*
T_1—*Audio trans. P.P. input. (Stancor #52C or Thordarson 14A92)*
PL_1—*#47, 6.3 v. @ 150 ma. pilot light*
S_1—*D.p.d.t. toggle sw.*
S_2, S_3—*S.p.s.t. toggle sw.*
2—30B5 tubes *1—12AT6 tube*

Fig. 2 Schematic diagram of signal generator. The standard 100 kc. crystal can be adjusted to zero beat with WWV. The harmonics can then serve as accurate frequency markers throughout the radio spectrum.

A Television Oscilloscope

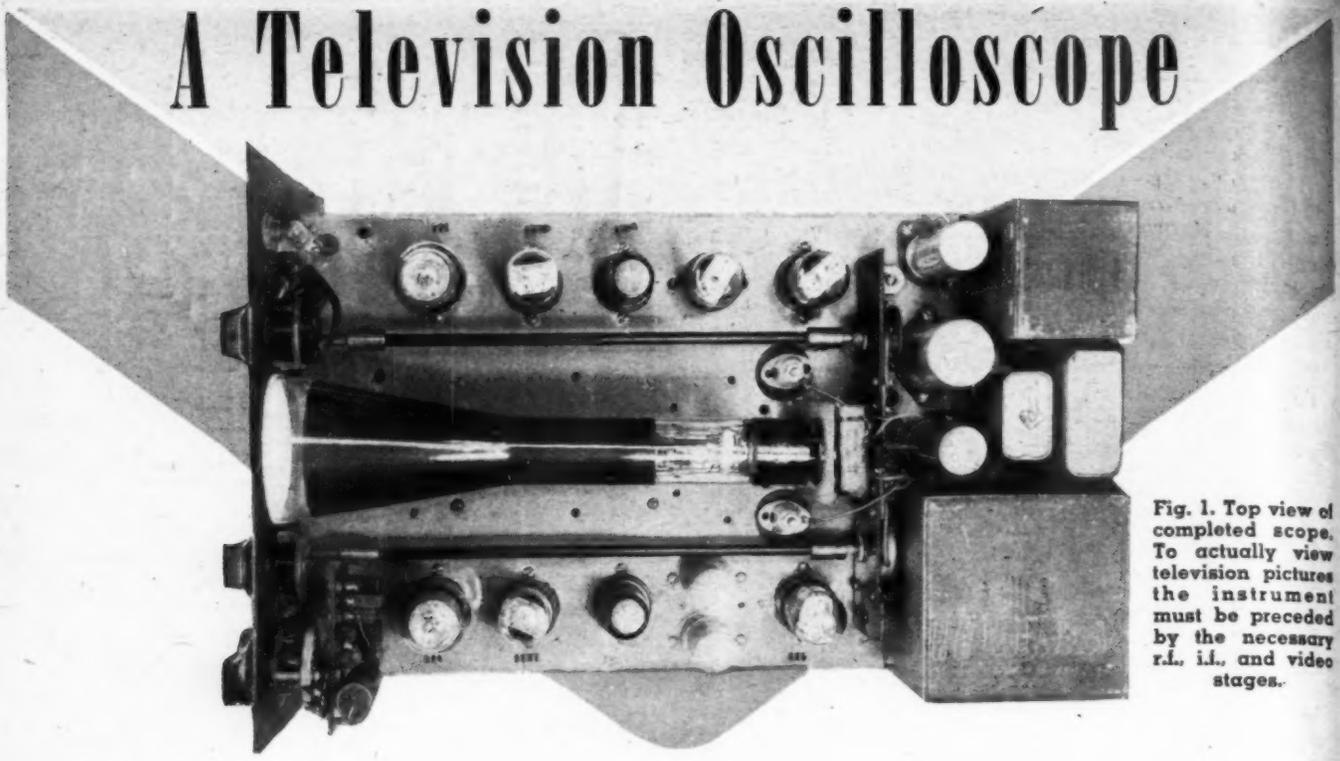


Fig. 1. Top view of completed scope. To actually view television pictures the instrument must be preceded by the necessary r.f., i.f., and video stages.

By
L. H. VanARSDALE, JR.

Part 2. Concluding article on the construction of a TV oscilloscope. This test instrument can also be used as part of a television receiver.

IN the first installment of this series presented in last month's issue, the various requirements for an oscilloscope suitable for general television use were discussed, and some circuits were given illustrating these various points. The reader may have found such a technical essay a bit dry, but understanding the engineering basis for a piece of electronic equipment makes its construction and use considerably more enjoyable and satisfactory.

This second installment describes an instrument designed around the previously outlined principles. This instrument is suitable for observing, with excellent fidelity, the various waveforms found in television receiving equipment. It will also serve all the more common test functions for audio equipment, and —most appealing to the television newcomer—the instrument may be used to actually view television pictures when preceded by the necessary r.f., i.f., and video stages!!

Figs. 1, 3, and 7 show the top, panel, and bottom views of the complete Television Oscilloscope. The instrument utilizes ten tubes including the 3-inch cathode-ray tube. Three tubes are required for the various power supplies; two tubes are used in each of the two deflection amplifiers; one gas triode tube is used in each of the two saw-tooth scanning oscillators.

Circuit Details

Fig. 2 shows a block diagram of the complete circuit, and Fig. 4 is the circuit diagram. It will be found helpful in studying the circuit to refer occasionally to the block diagram in order to keep the relationship between the various parts of the circuit in mind. The heart of the instrument is the 3-inch cathode-ray tube. This size was chosen as it gives a comfortable viewing area, yet permits the instrument to be conveniently portable.

A brief study of the circuit will reveal that the instrument is entirely straightforward. The only unfamiliar circuit is that of the power supply, which makes use of a voltage tripling arrangement to supply the high voltage to the cathode-ray tube; and a voltage doubler, which is a part of the voltage tripler, to supply all other d.c. voltages for the set. By such an arrangement, standard receiving type rectifier tubes may be used. All voltages aside from the 2.5 volts for the cathode-ray tube filament, including the 1200 volts for the cathode-ray tube anode, may be supplied from a standard 70 ma. power transformer having approximately 375 volts each side of center tap.

While discussing this power supply, one possible change should be noted. The transformer shown in this instrument is one of the "war surplus" variety and happened to have two 6.3 volt filament windings instead of the usual one 6.3 volt and one 5 volt windings. As a result, V_{10}, which is the only tube supplied by the second filament winding, was chosen as a 6X5. However, if this second filament winding is for 5 volt tubes, V_{10} should be changed to a 5W4, 5Z4, etc.

V_{10} and V_{11} are connected as voltage doublers and supply plus 775 volts to the amplifier and oscillator stages. This supply must be very well filtered since the slightest ripple will show up as an annoying "wiggle" of any pattern or picture being observed. The 40 μfd. electrolytic condensers used in this supply must have 450 volt ratings so that the two series groups will withstand the 775 volts without difficulty. The resistors shunting these condensers are important as they equalize the voltage drop across each of the two condensers in series.

V_{12} is the third tube making up the voltage tripler supplying the cathode-ray tube. The 425 volt output of this part of the circuit is poled with the plus grounded and the minus hot. This minus lead is connected to the grid-cathode end of the high voltage divider, placing the cathode-ray tube grid and cathode approximately 425 volts below ground, and the second anode about 775

volts above ground, thus making a total of 1200 volts supplying this tube.

The usual four controls for the cathode-ray tube; Intensity (R_{34}), Focus (R_{32}), Horizontal Centering (R_{24}), and Vertical Centering (R_{25})—are to be found in the voltage divider associated with the cathode-ray tube which connects across the 1200 volt supply. Sufficent centering adjustment has been provided to permit moving the pattern the full screen width both horizontally and vertically.

The "Input Selector" switches, S_1 and S_3, for both amplifiers have three positions and determine what is fed to the respective channels. The first position, which occurs when the knob points to the gain mark, connects the "H. Amp. In" jack directly to the grid of the cathode follower, which is the first tube in each deflection amplifier. In this position, inputs up to 20 volts peak-to-peak may be viewed. In the "Low" gain position of the "Input Selector", the input terminal is connected to the cathode follower grid through a 10 to 1 attenuator permitting observation of voltages up to 200 volts peak-to-peak. Voltages larger than this latter value may be observed either by connecting directly to the deflection plates as provided for at the rear of the chassis, or by adding an external attenuator at the input jack. Most waveforms to be observed in television and audio work, however, fall within the input limits provided.

In the "Scan" position of the "Horiz. Input Selector" and "Vert. Input Selector" switches, the 775 volts d.c. is applied to the scanning oscillators, and the outputs of the oscillators are, in turn, connected to the inputs of the deflection amplifiers through attenuators. The saw-tooth-shaped output voltage from a gas triode scanning oscillator, such as used in this instrument, is considerably in excess of what is required by the amplifier, hence the output attenuator is included to reduce this voltage to a more usable value. Details of the attenuators for both the "Low" and "Scan" positions were given in Part 1. It will be recalled that the purpose in the arrangement of condensers and resistors is to keep the amount of attenuation constant at all frequencies and thus prevent any frequency discrimination in this part of the circuit.

The circuits for the scanning oscillators also follow the description given previously. It will be noted that minor differences do, however, exist between the horizontal oscillator, V_1, and the vertical oscillator, V_6. These differences are in the "Horizontal Scan Frequency" selector switch, S_4, and the variable cathode bias adjustment, R_7, provided in the horizontal oscillator, neither of which are required for the vertical oscillator. This arises from the fact that the vertical scanning oscillator is intended to operate over only one range of 25 to 60 cycles, while the horizontal oscillator must operate from 20 to 20,000 cycles.

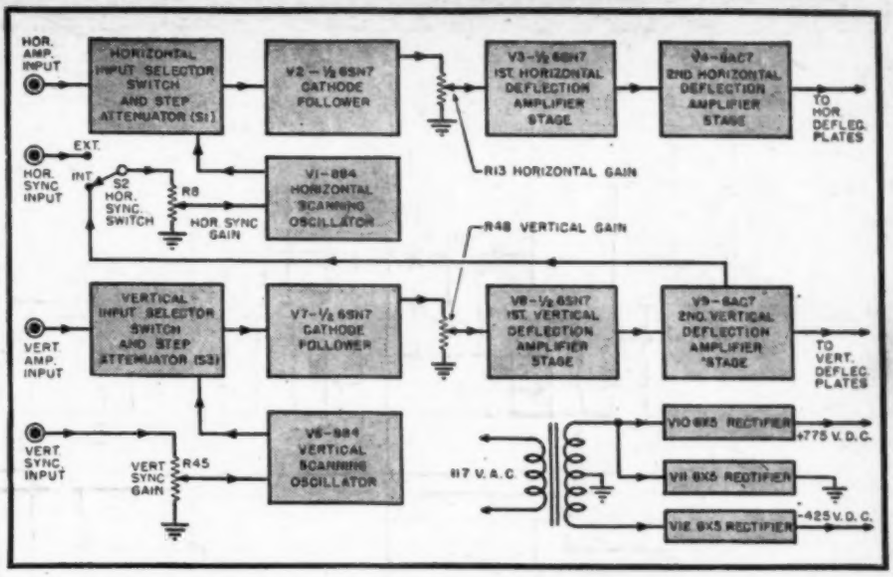


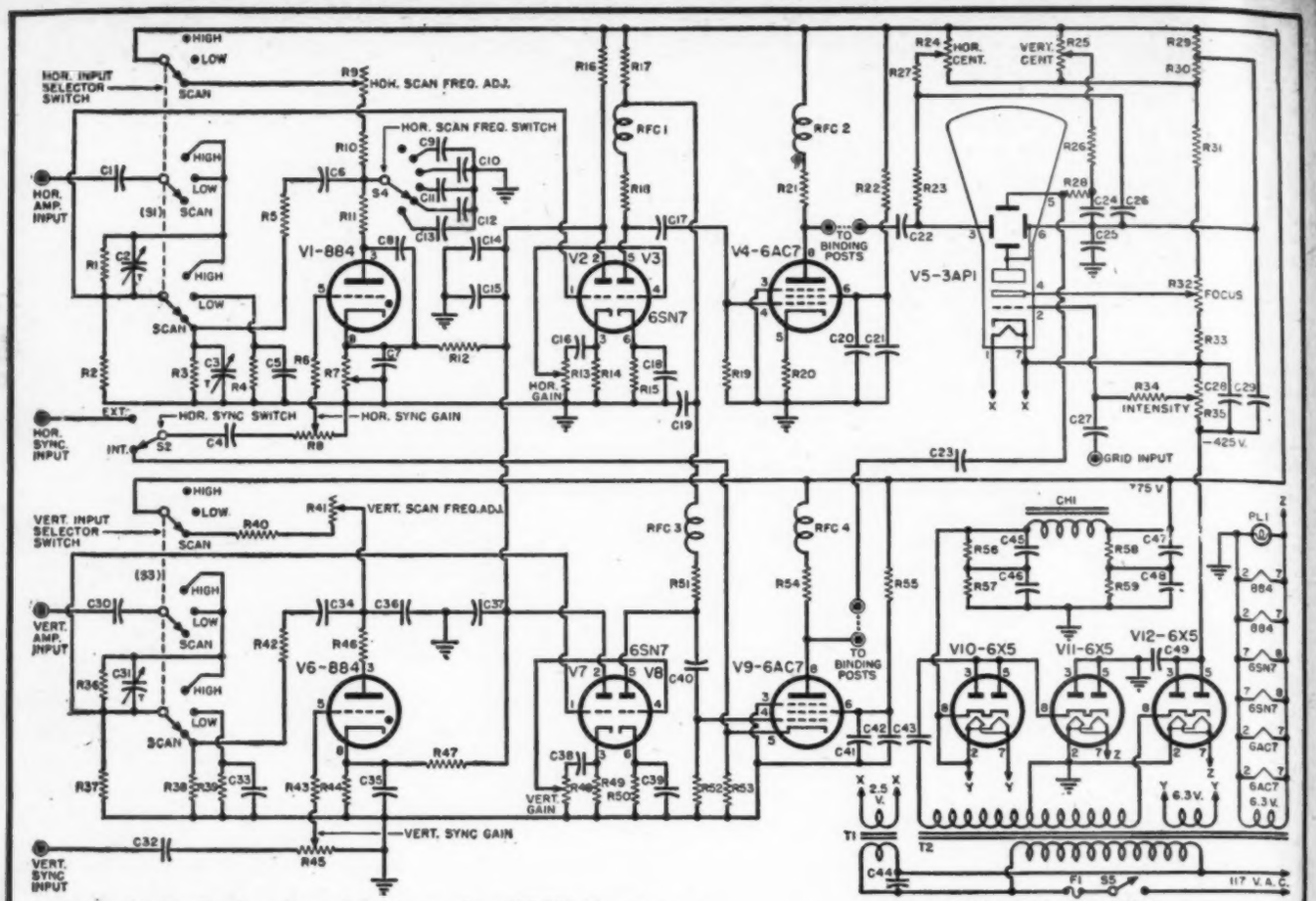
Fig. 2. Simplified block diagram shows functional operation of TV oscilloscope.

The vertical oscillator is required only when the oscilloscope is used to observe actual television pictures. It will operate at 30 cycles per second, the frame frequency for 120 line amateur-standard television pictures, and at 60 cycles per second, the field frequency for 525 line commercial standard television pictures. It will be noticed that the vertical scanning oscillator may be synchronized from an external source only, while a switch, S_2, is provided so the horizontal oscillator may be synchronized either internally or externally. Selecting the exact value of R_{44} requires special care, and is discussed under the heading of "Testing and Adjustments."

The cathode resistor, R_7, for V_1 has been made variable so that the tube's oscillations may be made to coincide with the panel markings adjacent to the "Horizontal Scan Frequency" switch, S_4. R_7 is located on the chassis, inside the instrument, directly under the group of condensers mounted on S_4. The 25 μfd. cathode-condensers, C_7 and C_{35}, are required to maintain the bias on the scanning oscillator tubes constant during their ionized periods, i.e., during the return traces.

Both the horizontal and vertical deflection amplifiers have been made identical for the purpose of simplifying the

Fig. 3. Front panel view showing proper placement of all operating controls.



R_1, R_2, R_5, R_{34}, R_{36}, R_{37}, R_{42}—2 megohm, ½ w. res.
R_3, R_{38}—300,000 ohm, ½ w. res.
R_4—200,000 ohm, ½ w. res.
R_6, R_{43}—25,000 ohm, ½ w. res.
R_7—3000 ohm pot.
R_8, R_{45}—50,000 ohm pot.
R_9—5 megohm pot.
R_{10}—800,000 ohm, ½ w. res.
R_{11}, R_{46}—500 ohm, ½ w. res.
R_{12}, R_{47}—150,000 ohm, 1 w. res.
R_{13}, R_{48}—10,000 ohm pot.
R_{14}, R_{49}—10,000 ohm, 1 w. res.
R_{15}, R_{50}—1,300 ohm, ½ w. res.
R_{16}, R_{17}—50,000 ohm, 2 w. res.
R_{18}, R_{51}—40,000, 2 w. res.
R_{19}, R_{39}, R_{52}—250,000 ohm, ½ w. res.
R_{20}, R_{53}—750 ohm, 1 w. res.
R_{21}, R_{54}—40,000 ohm, 4 w. res.
R_{22}, R_{55}—350,000 ohm, 1 w. res.
R_{23}, R_{28}—5 megohm, ½ w. res.
R_{24}, R_{25}—1 megohm pot.
R_{26}, R_{27}—500,000 ohm, ½ w. res.
R_{29}, R_{30}—250,000 ohm, 1 w. res.
R_{31}—500,000 ohm, 1 w. res.
R_{32}—250,000 ohm pot.
R_{33}—300,000 ohm, 1 w. res.
R_{35}—50,000 ohm pot. (with sw.)
R_{40}—680,000 ohm, ½ w. res.
R_{41}—3 megohm pot.
R_{44}—2,600 ohm, ½ w. res.
R_{56}, R_{57}, R_{58}, R_{59}—200,000 ohm, 1 w. res.
C_1, C_{13}, C_{30}—.25 mfd., 600 v. cond.
C_2, C_3, C_{31}—3-30 mmfd. mica trimmer
C_4, C_{15}, C_{24}, C_{26}, C_{37}—.1 mfd., 400 v. cond.
C_5, C_{33}—100 mmfd. mica cond.
C_6, C_{17}, C_{34}, C_{36}, C_{40}—.5 mfd., 600 v. cond.
C_7, C_{16}, C_{35}, C_{38}—25 mfd., 25 v. elec. cond.
C_8—400 mmfd., mica cond.
C_9—.002 mfd. mica cond.
C_{10}—.006 mfd. mica cond.
C_{11}—.025 mfd., 600 v. cond.
C_{12}—.07 mfd., 600 v. cond.
C_{14}, C_{19}, C_{20}, C_{41}—10 mfd., 450 v. elec. cond.
C_{18}, C_{39}—.003 mfd., mica cond. (See text)
C_{21}, C_{32}, C_{42}—.01 mfd., 600 v. cond.
C_{22}, C_{23}—.25 mfd., 1000 v. oil-filled cond.
C_{25}—1 mfd., 1000 v. oil-filled cond.
C_{27}—.05 mfd., 600 v. cond.
C_{28}—4 mfd., 200 v. elec. cond.
C_{29}—.5 mfd., 2000 v. oil-filled cond.
C_{43}, C_{45}, C_{46}, C_{47}, C_{48}—40 mfd., 450 v. elec. cond
C_{44}—.1 mfd., 600 v. cond.
C_{49}—4 mfd., 450 v. elec. cond.
RFC_1, RFC_2, RFC_3, RFC_4—16 millihenry r.f. choke
CH_1—30 hy., 70 milliamp filter choke
S_1, S_3—3 p.3-pos. tap sw.
S_2—S.p.d.t. toggle sw.
S_4—S.p. 6-pos. tap sw.
S_5—On-off sw. (on R_{35})
T_1—Fil. trans., 2.5 v. 3 amps.
T_2—Power trans., 375-0-375 v. 70 ma.; 6.3 v. 5 amps.; 6.3 v. 1 amp. (See text)
F1—117 v. line fuse
PL_1—6.3 v. pilot light
1—3AP1 tube
2—884 tubes
2—6SN7 tubes
2—6AC7 tubes
3—6X5 tubes

Fig. 4. Complete schematic diagram of the television oscilloscope.

construction and design, and because of the added fact that the circuit requirements are nearly the same. The complete horizontal amplifier, for example, consists of the "Horiz. Input Selector" switch, S_1, the ½6SN7 cathode follower triode, V_2, and two stages of amplification made up of the ½6SN7 triode, V_3, and the 6AC7 pentode, V_4. Voltages to be observed on the cathode-ray tube screen are fed from the "Horiz. Input Selector" switch to the cathode follower, V_2. This tube is provided with a variable output control permitting fine adjustment of the pattern size. From this control the signal is then fed through the two-stage wideband deflection amplifier and applied to the deflection plate.

The two stages of amplification have been designed in accordance with the procedure described in the previous installment to have a substantially flat frequency response from 20 to 200,000 cycles with an available gain in excess of 150. This wide frequency range is achieved by utilizing smaller-than-usual plate load resistors (40,000 ohms) and placing in series with these resistors an inductance which will further assist in keeping the gain constant at higher frequencies. The small cathode bypass condensers, C_{18} and C_{39}, also aid the high frequency response. Incidentally, it was through coincidence that the values for the plate load resistors and peaking chokes for the first and second amplifier stages calculated to approximately the same value.

One other important feature of the deflection amplifiers should be noted at this point. Inspection of the circuit in Fig. 4 will reveal that the cathode resistors of both output deflection amplifier tubes, V_4 and V_9, have been left unbypassed. This connection introduces a considerable loss in gain per stage when compared to a circuit having a large cathode bypass condenser, but it has advantages which far outweigh these losses

Two principal effects are achieved. First, any tendency toward non-linear distortion in the stage is corrected, and second, peak-to-peak output voltages in excess of 60% of the available d.c. high voltage may be obtained without appreciable distortion. This latter feature is

of particular importance, since it permits deflections in excess of 1½ times the cathode-ray tube screen width to be utilized, when required. Two other minor benefits are also achieved, namely, the flatness of the frequency response is assisted, and no care is required in selecting amplifier tubes, since the degeneration permits any good tube to operate equally well.

While small condensers, C_{18} and C_{39}, have been connected across the cathode resistors, R_{15} and R_{50}, of the two triode amplifiers, these stages, too, may be considered degenerative for all but the higher frequencies around 200 kc., since these cathode condensers are only effective at these frequencies. Their primary function is to assist in maintaining the high-frequency response of the amplifier, and their use is discussed more fully under "Testing and Adjustment."

Construction

This complete oscilloscope is built on a steel chassis measuring 10" wide x 17" deep x 4" high. The etched front panel measures 11½" x 9". All power supply components have been grouped at the rear of the chassis to isolate them as much as possible from the cathode-ray tube and associated circuits which occupy the front. The etched metal nameplate making up the front panel, shown in Fig. 3, was used since the multiplicity of controls makes memorizing difficult. It will be noted, however, that the controls have been laid out in accordance with a definite system, since all horizontal controls fall to the left of center while all vertical controls are to the right. In addition, the position of the various horizontal and vertical controls which perform similar functions have been arranged in complementary panel positions.

For those not having had previous experience in the construction of equipment utilizing cathode-ray tubes, it is suggested that the construction procedure be followed in the order given. By so doing, an instrument of this type becomes "self-checking", i.e., the proper performance of the circuits may be checked as the construction progresses directly on the cathode-ray tube itself.

To begin with, both the chassis and panel should be laid out, the holes for all tube sockets and controls drilled, and the various sockets and controls mounted. The only components requiring special attention in mounting are the power transformer and electrolytic filter condensers. The transformer utilized in the instrument shown in Figs. 1 & 7 is a fully-shielded unit, and very little external leakage flux is present to cause magnetic interference to the cathode-ray tube. Such a shielded unit should be used if possible, but if not procurable, a standard half-shell replacement transformer may be used. If this latter

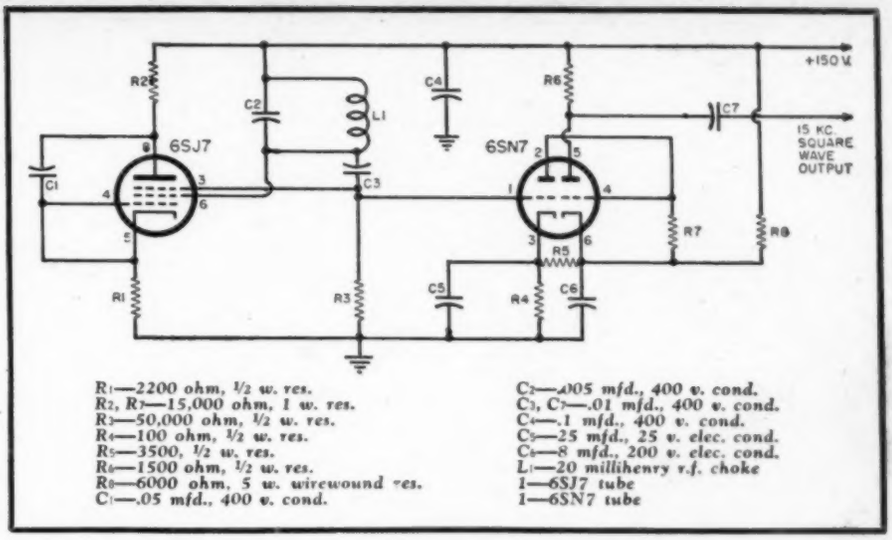


Fig. 5. Circuit for simple square-wave generator suitable for checking high frequency response and attenuator adjustments for TV scope deflection amplifiers.

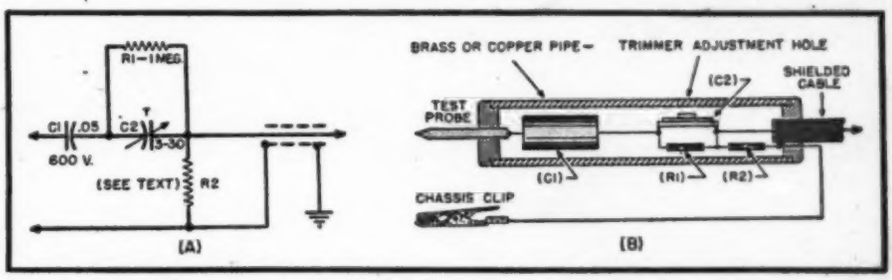


Fig. 6. (A) Schematic diagram of wide bandpass test prod and cable for use with television oscilloscope. (B) Physical layout for the test prod and the cable.

type transformer is used, it is important that it be mounted as far to the rear as possible and *directly behind* the cathode ray tube, preferably *under* the chassis, if the parts can be so arranged. Such placement will tend to minimize the magnetic interference that may be present.

It will undoubtedly be found most satisfactory to utilize electrolytic condensers in cans for the various high-capacity filters, since these afford convenient connection terminals and are mounted easily. It should not be overlooked that the two filter condensers, C_{45} and C_{47}, adjacent to the filter choke must be in separate cans, and these cans must be insulated from the chassis as must C_{49}. This is readily accomplished with the condensers shown in the instrument, since both non-insulated and

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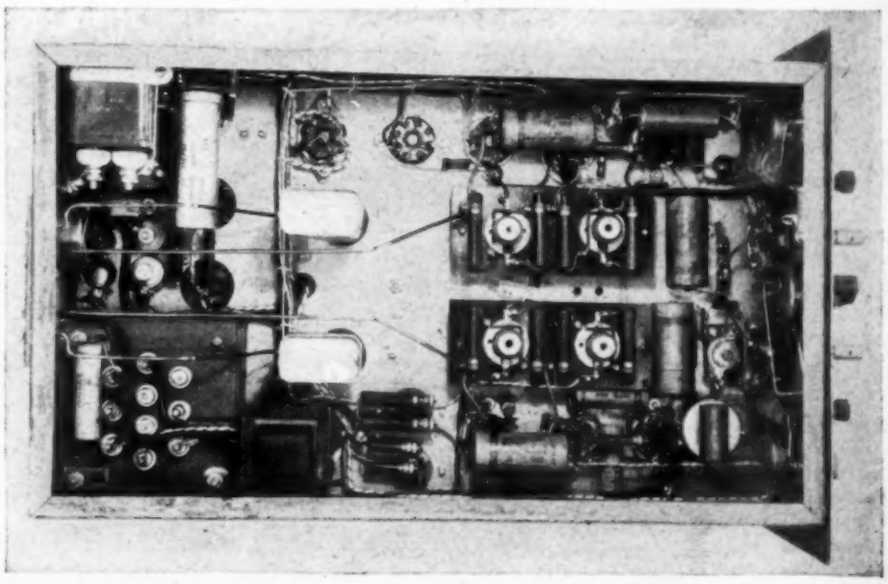
Fig. 7. Under chassis view of the television oscilloscope.



The Ideal Grid Dip OSCILLATOR

By JAMES N. WHITAKER, W2BFB

Details for constructing a versatile, self powered unit which has many uses. The ham or serviceman can use it often in his work.

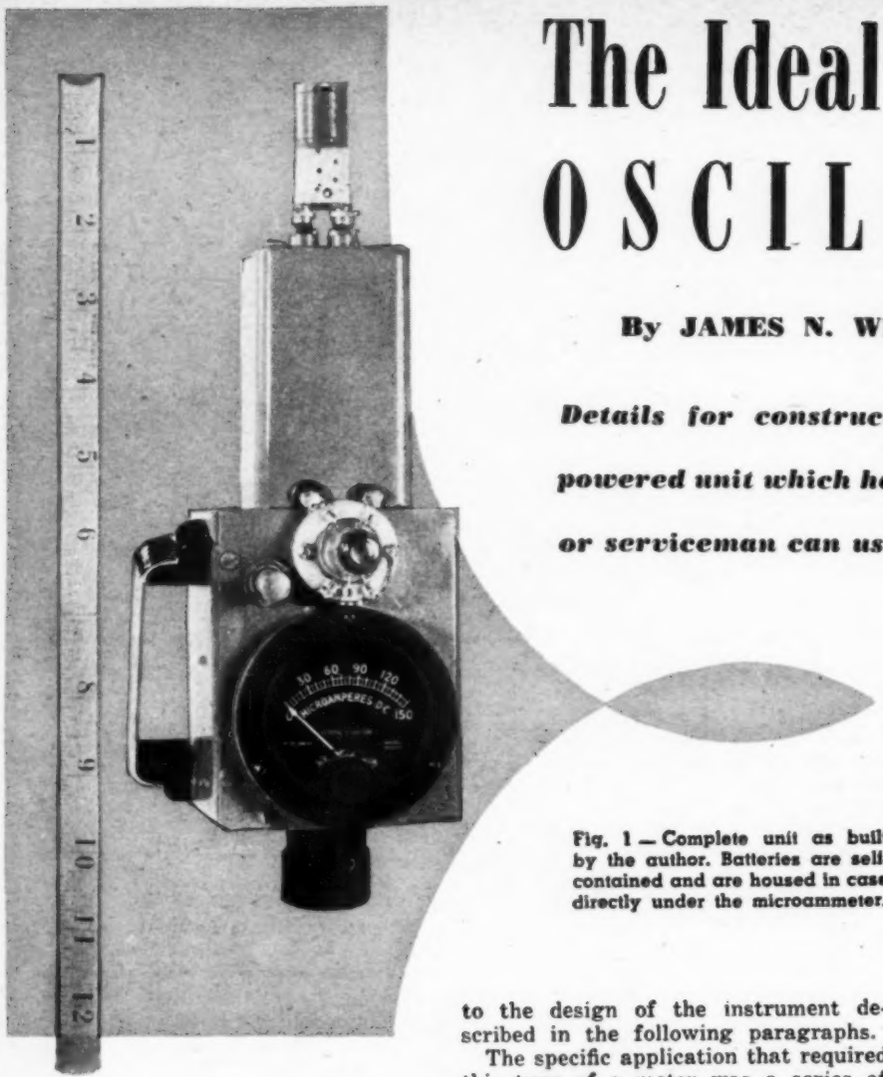


Fig. 1 — Complete unit as built by the author. Batteries are self-contained and are housed in case directly under the microammeter.

A GOOD grid dip oscillator has become a most necessary instrument for all laboratories and experimental workshops. It can be used for such a wide variety of purposes that it is almost as essential as a voltmeter. It serves as a wavemeter to measure the frequency of tuned circuits before the circuits are energized by the equipment in which they are used. It is a heterodyne frequency meter, an absorption wavemeter having greater than usual sensitivity, and many other things. This versatile instrument is old to the art of radio, but seems to have been forgotten for a period of time only to be rediscovered recently. At the present time there are a number of different versions of this instrument available commercially, and several others have been described in various recent publications. The circuits used are similar in many respects. None are entirely satisfactory for all uses, either because of the physical size, or need for power supply cables, etc. The ideal grid dip oscillator must be as easy and simple to use as a flashlight, and yet be sufficiently accurate for all but very precise measurements. It was the need for such an instrument that prompted the investigations leading up to the design of the instrument described in the following paragraphs.

The specific application that required this type of a meter was a series of antenna investigations. The measurements were to be made at the antenna, which was mounted on the top of a fifty foot high tower. Even the most compact of grid dip oscillators described in the past required a long length of wire to provide the necessary power. The connecting cable was continually in the way of the user, and also presented somewhat of a hazard when used in such precarious positions as out on the end of the boom supporting an antenna array far above the ground.

The radiated power from a grid dip oscillator does not need to be of any appreciable magnitude. The smallest vacuum tube readily available will perform quite satisfactorily. The 957 tube was selected because of its low filament power requirements (1.5 v. at .050 amperes), and for its ability to oscillate freely with a relatively low plate potential. These factors permit the use of a "penlite" dry cell for the filament power, and a 67½ volt miniature "B" battery of the hearing aid type for the plate power. The tube is also physically small and therefore ideally suited to a compact design. The 957 being a filament type tube, it is of the instantly usable type, eliminating the need for filament power when not actually in use. This greatly prolongs the battery life.

Almost any self-excited oscillator circuit is suitable for use in a grid dip oscillator. If the instrument is to cover a wide frequency range where coil changing is required, the most practical circuit is the well-known Colpitts oscillator, since this system uses a two terminal inductance, with the electrical center tap provided by the split stator type tuning condenser.

The over-all mechanical arrangement may be that which best suits the builder, bearing in mind the following requirements. The inductance should extend well out beyond all other metal parts in such a manner as to permit coupling to the circuit under investigation without bringing too much of the metal case into the field of the coil or other inductance being measured. The complete instrument, including batteries, should be as light in weight as possible. It should be equipped with a handle located at a position convenient for both carrying and operating the instrument. The distribution of weight with respect to the handle must be carefully considered, if the instrument is to be used without undue fatigue. The push-button filament switch should be located in a natural position for operation by the thumb of the holding hand, leaving the other hand free for the manipulation of the tuning control of the instrument or the device under investigation.

The usual precautions should be followed in the electrical design of the r.f. portions of the circuit. The circuit as a whole is not at all critical, but the shorter and more symmetrical the leads, the better the performance will be, particularly in the higher frequency ranges.

The instrument designed and built by the author is shown in Fig. 1. The batteries are located in the body of the instrument, under the microammeter. The weight of the batteries counterbalances the tuning system and induc-

tance extending out from the case, placing the center of gravity at the hand grip which is mounted on the left side cover. The filament push-button switch is located on the top adjacent to the tube, in a position normally under the thumb of the left hand when holding the instrument. The tuning dial and knob are located on the end of the assembly. The inductance is plugged in at the far end of the shield housing the tuning condenser.

Fig. 4 is the end view, showing the tuning control. Four of the plug-in coils are pictured beside the instrument. This view also shows that the hand grip is on an angle. This increases the ease and comfort in holding and using the instrument.

The electrical schematic diagram is shown in Fig. 2. The resistor R_1 across the tuning inductance L_1 will vary with frequency and is not used on the highest frequency coil. The purpose of this resistor is to maintain stability and amplitude of oscillations when the L/C ratio becomes unfavorable as it does on the lower frequencies. The value of R_1 is best determined by experimentation, as it will depend upon many factors. If this resistor is omitted, the meter reading for different values of inductance will vary greatly. If adjustments are made to obtain a satisfactory meter reading on the highest frequency, it will be found that the meter will read completely off scale when a larger coil is plugged in for the lower bands. In practice, the instrument is adjusted to give approximately ¾ full scale reading with the coil for the 28 mc. band in place. Resistors are added across the lower frequency band coils to produce the same approximate reading.

The grid current will not be constant over the entire range of tuning, but the change should be gradual and constantly in one direction with a given direction of rotation of the tuning control. With a larger value of tuning condenser C_1, the tuning range will be greater, but the errors in dial readings will be greater. The changes in the grid current will also increase. For the sake of accuracy, it is better to have more coils and use a lower capacity condenser, than to use a large condenser and try to cover a greater range with one coil. A satisfactory compromise will permit the range of each coil to overlap the amateur bands by a comfortable margin, with a separate coil used for each band.

The tuning condenser used in the instrument shown is a **Hammarlund** HFAD 50, with all except three rotor and three stator plates removed from each section. This condenser was chosen because it has ceramic end plates on both front and rear containing identical holes. This permits the condenser to be mounted to the main chassis, and also permits the bakelite jack panel to be mounted to the rear. The stator support rods run the full length of the condenser, permitting electrical connections to be made directly with a minimum of wiring. A "butterfly" type of variable condenser would be better for operation in the higher frequency bands, but would require some sort of a geared dial to provide ease of tuning and fineness of dial readings. The setup as shown performs admirably up to and including 30 mc. and probably could be operated at higher frequencies if desired.

Bakelite end plates are mounted on both ends of the tuning condenser by means of 6/32 screws and spacers. These bakelite plates are 2" square with rounded corners to fit into a standard 2" square shield can, such as is commonly used on i.f. coils. Holes are tapped in the corners of the rear end bakelite plate to permit the shield can to be held in place with screws. This plate contains two countersunk holes for the flat head screws used for mounting on the condenser end plate. Two "banana" jacks are mounted in the center of the bakelite end plate to receive the coil plugs. This general arrangement is shown in Fig. 3.

Fig. 3 indicates the manner in which the various parts of the tuned circuit are mounted and connected. The shield can that houses the tuning condenser has sufficient clearance to permit the plate and grid blocking condensers, as well as the grid resistor, to be mounted as indicated in the drawing. The grid and plate leads are brought out through rubber grommets to the tube socket terminals. Grooves are cut in the shield can to accommodate the grommets. The blocking condenser leads are soldered directly to the approximate centers of the stator support bars as indicated, to maintain symmetry in the circuit. The stator connecting lugs are bent down to meet the lugs under the coil jack nuts, and soldered in place.

Dimensions of the various spacers are not given, as they are not critical, and can be made any convenient length to suit the builder. As long as the general trend is followed, keeping in mind the major requirements, satisfactory operation will be assured.

The main body of the instrument contains the r.f. choke RFC and the batteries, switch, meter, and the meter

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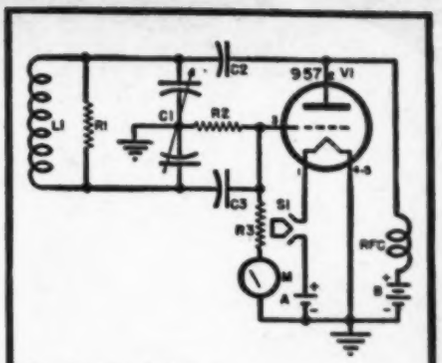


R_1—See note below
R_2—47,000 ohm, ¼ w. metalized res.
R_3—100,000 ohm, ¼ w. metalized res.
C_1—Air cond. (Hammarlund HFAD50 modified, see text)
C_2 C_3—100 mmfd. mica cond.
S_1—S.p.s.t. push-button sw. (normally open)
RFC—2.5 millihenry r.f. choke.
M—150 microamperes, 2½" d.c. meter
V_1—957 tube
L_1—26.4-31 mc.—8½ t. #24 en. wire on ¼" form, spaced 32 t. per inch. R_1 not used
13.5-18 mc.—21½ t. #24 en. wire on ¼" form, spaced 32 t. per inch. R_1—220,000 ohms, soldered across coil
6.8-8.1 mc.—43 t. #28 en. wire close-wound on ¼" form. R_1—100,000 ohms soldered across coil.
3.45-4.6 mc.—100 t. #28 en. wire close-wound on ¼" form. R_1—47,000 ohms soldered across coil.

Note: Where R_1 is required use resistor such as Allen Bradley ¼ watt type, inside coil form, soldered across lugs under plug where ends of winding terminate.

Fig. 2 — Circuit diagram of the complete grid dip oscillator. Note resistor R_1 is not used with the 26.4-31 mc. coil.

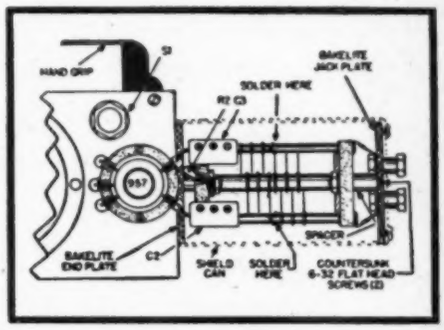
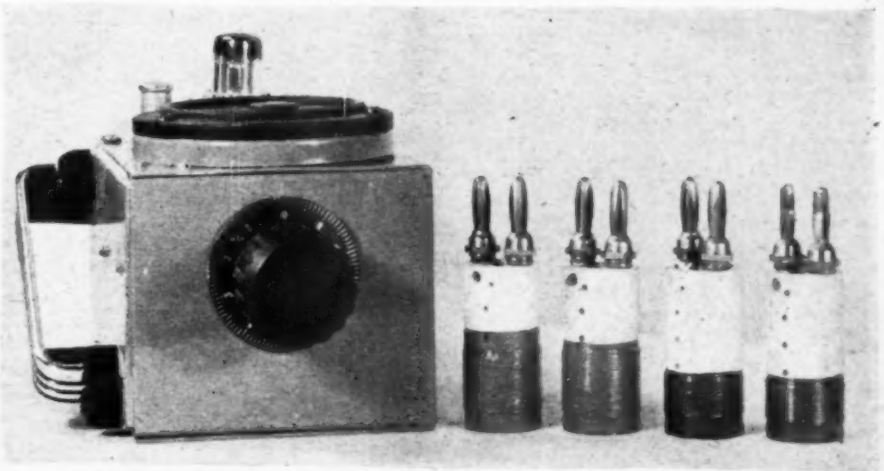


Fig. 3 — Cutaway view shows details of mechanical construction of the unit.

Fig. 4 — Completed unit shown with its set of four plug-in coils. These coils cover 3.45-4.6, 6.8-8.1, 13.5-18, and 26.4-31 mc. Coils covering other frequencies may be used.



More PEP for your FM PILOTUNER

The addition of a 6AK5 i.f. stage increased the performance and range of this popular FM tuner without elaborate alterations.

By

MALCOLM H. BROWN

Underchassis view of Pilotuner with C_1 removed and R_1 wired into new position.

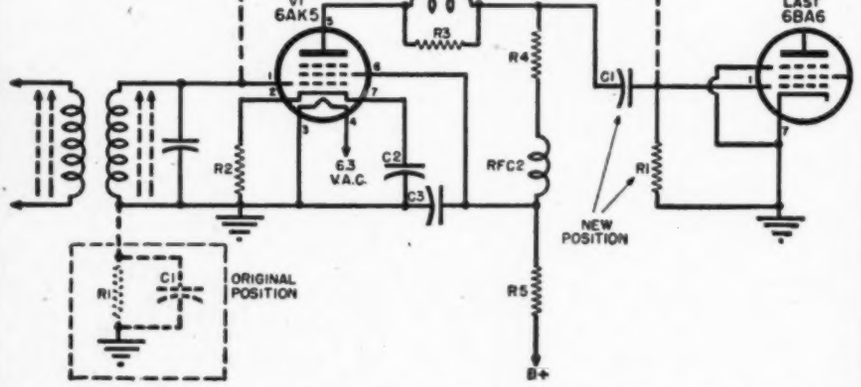
LIVING in a rather poor location for FM reception on the new frequencies, the nearest transmitter being hidden by hills so that reception is unreliable, it was a definite problem to get good reception on my newly acquired *Pilotuner* without using excessive audio gain.

After experimenting unsuccessfully with the built-in antenna, I installed an indoor dipole made up of two No. 16 enameled wires, each 27½ inches long with a two-inch insulator between and a lead-in consisting of a twisted pair as used with a prewar short-wave receiving antenna. This brought the signal strength up so that, with the dipole oriented in a north-south direction, fairly good reception was possible from both transmitters to the east. The weaker transmitter, however, was difficult to tune as the silent spot centered between the noise sidebands was very narrow, and the drift of the *Pilotuner,* even though very low, was still sufficient to require fairly frequent retuning. An effect similar to that of an AM receiver slightly off tune was also present, accentuating the higher audio frequencies and causing ignition noises to linger to a greater extent on the weaker stations.

I assumed that these effects were caused by low signal strength but I did not want to install a dipole on the roof for two reasons. First, the mounting and lead-in problems were unusually difficult, and second, the tree branches and power lines at my location would screen the signal to an extent at least as great as the screening caused by using an indoor antenna. Besides the local police and fire radio service had run into a pronounced dead spot at a slightly higher elevation than my indoor antenna and their transmitter was also located to the east.

Another i.f. stage with a gain of from 8 to 12 would bring the signal presented to the ratio detector high enough to make tuning easier and the quality better, as the center frequency presented to the detector would appear broader. In making this assumption I was guided by the fact that a fourth FM station to the west, with higher radiated power, could be received with much greater signal strength than the other stations as its signals for the metropolitan area to the east are beamed directly over my house. The advantages of greater signal strength were readily apparent when listening to this station and suggested the incorporation of additional gain.

Diagram shows changes made in the original circuit of the Pilotuner.



R_1*—100,000 ohm, ½ w. res. + or —10%
R_2—150 ohm, ½ w. res. + or —10%
R_3—12,000 ohm, ½ w. res. + or —5%
R_4—2400 ohm, ½ w. res. + or —5%
R_5—1000 ohm, ½ w. res. + or —10%
C_1*—.0015 mfd., 300 v. ceramic cond.
C_2, C_3—.001 mfd., mica cond.
RFC_1—50 microhenry video peaking choke (See text)
RFC_2—25 microhenry video peaking choke (See text)
V_1—6AK5 tube
* Use original components

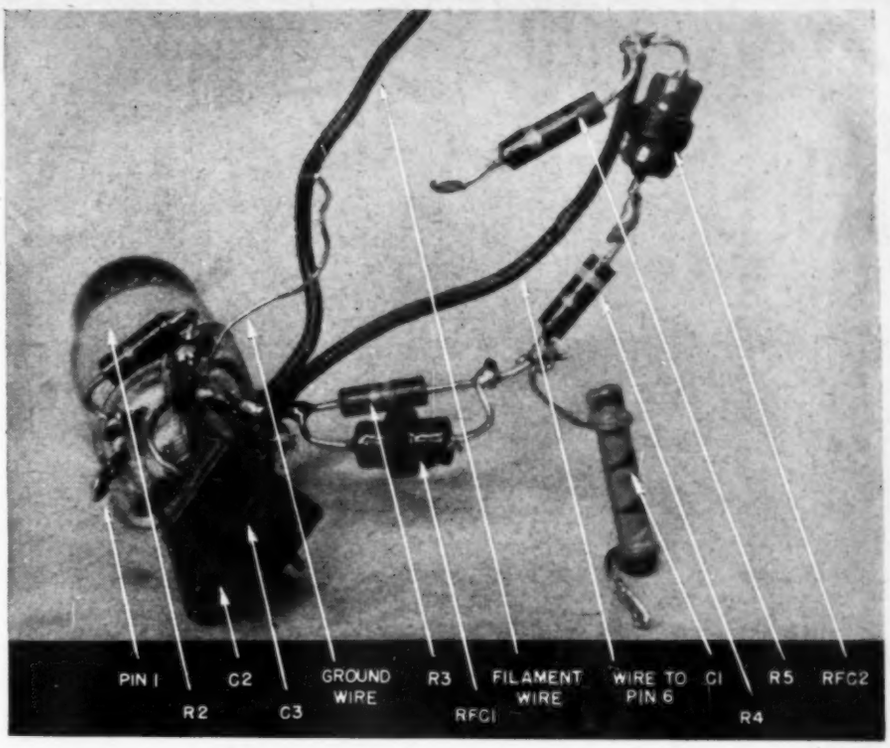
There is insufficient space in the *Pilotuner* for a coil can containing a 10.7 mc. i.f. assembly plus a tube and its associated wiring. However, under the chassis between the oscillator coil and the electrolytic filter condenser there is room to add a 6AK5 tube and socket plus the necessary parts for a series-shunt peaking i.f. circuit. In addition to occupying a very small space, this stage requires no tuning, which means that additional i.f. gain can be had without upsetting the factory tuning.

Circuits of this type have become quite common with the advent of television and very wide bands can be amplified with reasonable gains. As the frequencies we are interested in here are 10.7 mc. plus and minus 75 kc. the large components necessary to make the low frequency response good are not needed and all the parts required are relatively small. A further advantage is that the space chosen for this added tube permits connection to its grid with no increase in lead length.

In the design of the series-shunt peaking circuit the values chosen were adapted to standard values of resistors and condensers. The coils used in the circuit are ordinary video peaking coils wound on bakelite forms and are of the low-*"Q"* type. These are available from *The National Company* as No. R33. This unit is a dual section r.f. choke and can be secured in the 50 microhenry size. By removing one section the remainder will do for the 25 microhenry coil.

There probably are some video peaking chokes available in the assorted components that sell for a few cents or so in the war surplus items. The easiest way to get the values shown would be to measure the inductance on a *"Q"*-meter and, if necessary, strip off enough turns to reach the required values. With universal wound coils care should be taken in this stripping operation as the inductance will go down by a factor of greater than two with respect to the linear length of wire.

An alternative method of measuring the small inductances would be to use an r.f. oscillator. By shunting a small condenser of known value across the coil and connecting the assembly directly across the output terminals of the oscillator the output voltage will be a maximum at the resonant frequency of the combination. This can be read directly on the oscillator output meter or if care is taken to isolate the input capacity of the device with a resistor of 100,000 ohms or so, with a separate v.t.v.m. or a cathode-ray oscilloscope. Shunting the 50 microhenry coil with a 50 micromicrofarad condenser the resonant point will come at about 3.18 mc. Using the same condenser with the 25 microhenry coil, the frequency will be about 4.5 mc. With care this reading can be made to better than 5% which will be accurate enough for this circuit.

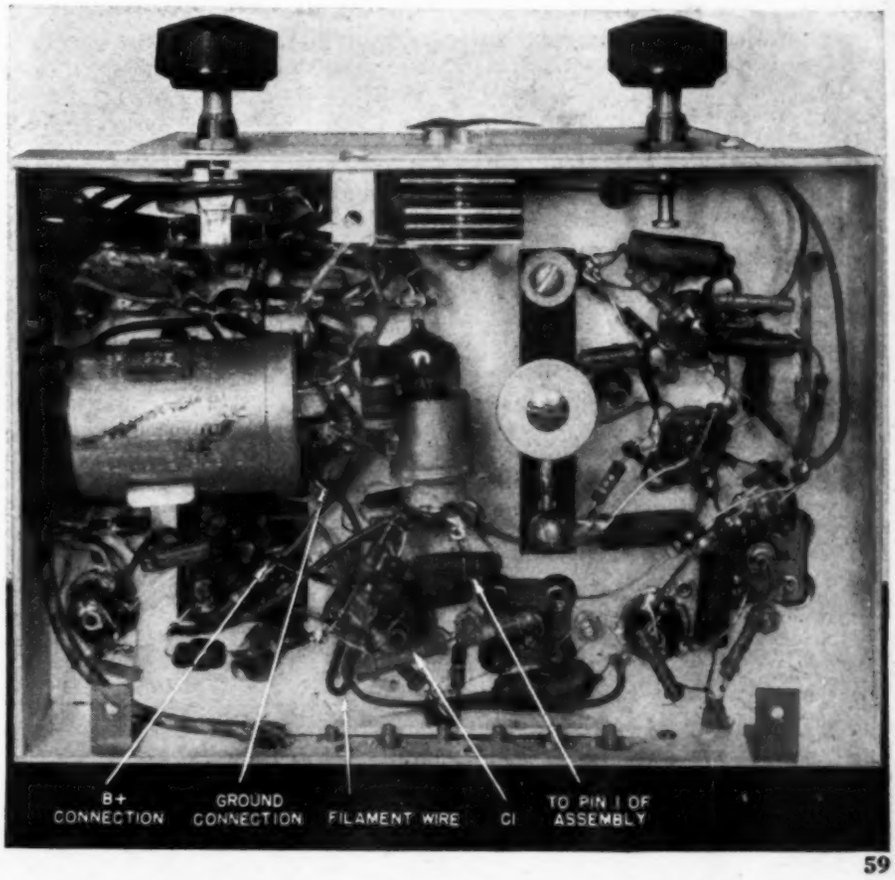


New tube and components shown ready to insert in the Pilotuner chassis.

As in all video circuits the high frequency response of any stage is dependent on the output capacity of the tube, the input capacity of the following stage, the wiring capacity of the circuit plus the load resistance used with the tube. The inductances are used to increase the load resistance of the tube as the frequency increases to compensate for the losses caused by the

(Continued on page 150)

Assembly wired into place. Note that it is installed as far as possible from the oscillator coil. Assembly is supported by its connecting wires.



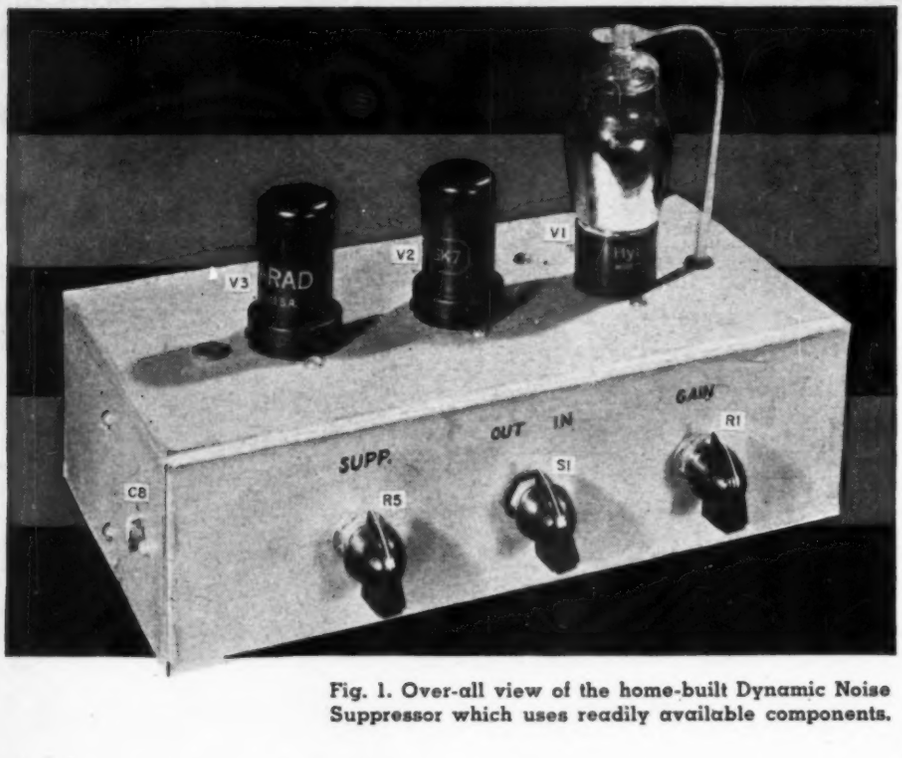


Fig. 1. Over-all view of the home-built Dynamic Noise Suppressor which uses readily available components.

The RECORDING and REPRODUCTION of SOUND

By OLIVER READ
Editor, RADIO NEWS

Part 15. Theory, design, and construction of a Dynamic Noise Suppressor that uses standard parts.

A PROPERLY designed Dynamic Noise Suppressor is an extremely worthwhile adjunct to any high quality playback system. On the other hand, an improperly adjusted suppressor is worthless and will cause many a headache to the soundman. Therefore, one should not attempt to build a unit unless he has access to an accurate audio oscillator and an oscilloscope. In addition the builder will need to borrow a second audio oscillator, for initial adjustments.

The suppressor to be described has been stripped to a minimum of components and tubes. It is capable of doing an excellent job and may be built successfully by any well-informed radio technician. Construction should not, however, be attempted by the tyro.

Various types of amplifiers require special changes in component parts values for best results. Therefore, this suppressor should be inserted into audio channels having similar characteristics to that of the record-reproduce amplifier shown on page 56 of the January 1948 issue of RADIO NEWS.

Originally this amplifier was to contain the integral Dynamic Noise Suppressor circuit. Extended research, however, indicated the desirability of building it on a separate chassis so that if any further changes were needed, these could be made without "messing up" the amplifier. In addition, it was discovered that there was a tendency for the two chokes, CH^1 and CH^2 (Fig. 2) to pick up hum from within the amplifier. This hum has now been eliminated by employing a separate chassis.

All of the components fit nicely into a standard chassis measuring 9½"x5"x 3". Two automobile radio type connectors are provided on the chassis for the two shielded leads connecting the suppressor into the amplifier. The output voltage from C^6 (Fig. 4, page 56, January 1948 RADIO NEWS) connects to the input of the Dynamic Noise Suppressor. The output of the D.N.S. connects to the input of R^{11}. In other words, the D.N.S. is inserted at the junction between C^6 and R^{11} of the record-reproduce amplifier.

Necessary filament and plate voltage for the D.N.S. may be taken from the power supply of the amplifier. It is recommended that the +250 volts d.c. be taken from the screen of the 6V6 through an additional dropping resistor of 10,000 ohms and an added filter condenser of 16 μfd. Likewise, the filament voltage may be taken from the filament winding supplying the 6V6.

This simplified circuit of the Dynamic Noise Suppressor uses a 6B8G to provide the necessary voltage amplification so that sufficient drive will be available to the d.c. control circuits for 6SK7 reactance tubes. The desirability of the 6SK7 as opposed to a sharp cut-off pentode such as a 6SJ7 is associated with smooth and continuously variable action of the "gate" circuits. A sharp cut-off tube tends to produce an undesirable "on-off" effect while the transconductance of the 6SK7 may be varied over a wide range. The diodes in the 6B8G envelope are used to rectify the control voltage.

Since it is desirable to provide a control voltage for the high frequency reactance tube derived from the upper fundamentals, and a derivative of the harmonics of low frequencies to drive the low frequency reactance tube, suitable *RC* filter networks are inserted ahead of the diodes. The reason for making the control voltages selective with regard to frequency is to avoid the possibility of the noise (either low frequency rumbles or high frequency needle scratch) from developing sufficient voltage to open the gates.

The rectified control voltage is further filtered by the networks following the diodes and the resultant d.c. applied to the grids of the reactance tubes. The speed with which the gates will open is largely a matter of time constants of these networks. The closing speed is also controlled by this factor but is further affected by the maximum voltage to which the condensers have been charged. In other words, if x volts are required to open the gates fully and the signal is sufficiently large to develop $2x$ volts across the filter condensers, they must discharge down to x volts before the gates will begin to close. Thus the closing time is longer for large signals than for medium signals. In general this is desirable because large signals usually require a longer reverberation time for realistic reproduction. In the

more elaborate versions of the Dynamic Noise Suppressor these effects may be controlled more accurately by the use of a separate amplification stage for the d.c. control voltage and arrangements to limit the maximum control voltage that may be developed. However, this is not so important in the more limited range devices as it is in those designed to handle very wide frequency response ranges.

The use of the diodes in the 6B8G for rectifying the control voltage requires that the cathode of this tube be used as the effective ground return for all other tubes.

The resistors R^6 and R^7 are selected to divide the voltage properly so that an adequate drive will be available for the control circuits and also to produce a proper input impedance for the gate circuits. The "roll-off" ahead of the sharp dip in the high frequency gate circuit is a function of the value of these resistors. The series filter consisting of CH^1 and C^2 in parallel is tuned to resonate at 10 kc. It serves the dual purpose of holding down the very high frequencies when the gates are closed and the rise above resonance in the reactance tube circuit is appreciable in a region of considerable noise, and also provides the proper impedance for the shunt reactance tube tuned circuit to "work on." Since the condenser is capable of tuning this inductance over a broad range its inductance value is not extremely critical, but it is important that it be of high "Q" design.

The inductance CH^2 is also in a tuned circuit controlled by the condenser C^8 and its value is not critical although the "Q" is obviously important. C^7 is simply a blocking condenser to keep the plate voltage off the tuning condenser.

Analysis of these circuits will involve viewing the tube as a condenser in a tuned circuit. A simple method of understanding the results obtained is to think of it as a feedback device. A portion of the feedback voltage is applied to the grid of V^2 through condenser C^8. The voltage appearing on this grid is in phase with the signal on the plate. The grid voltage causes a corresponding change in plate current which produces a change in plate voltage that is 180 degrees out of phase with the input signal to the plate and is therefore degenerative.

The signal appearing in the grid circuit will vary with frequency in accordance with the characteristics of the network consisting of C^8 and R^{28}. The magnitude of the degenerative signal produced depends upon the transconductance of V^2. Under static conditions this will vary with the cathode bias developed across R^{10} and R^5 as well as the screen voltage. The screen voltage is held relatively constant by the divider

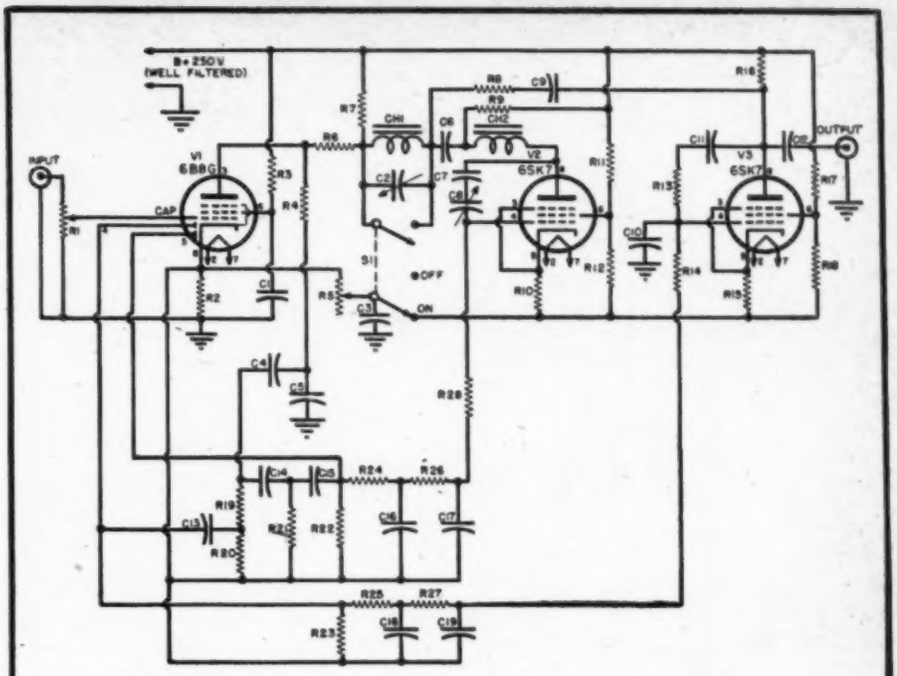

B+ 250V (WELL FILTERED)
INPUT
OUTPUT
V1 6B8G
V2 6SK7
V3 6SK7
CAP
OFF
ON
S1
R1—500,000 ohm pot.
R2—1,000 ohm, 1/2 w. res.
R3, R9, R16, R21, R24—470,000 ohm, 1/2 w. res.
R4, R6, R11, R17—100,000 ohm, 1/2 w. res.
R5—500 ohm rheostat
R7—33,000 ohm, 1/2 w. res.
R8, R28—47,000 ohm, 1/2 w. res.
R10, R15—330 ohm, 1/2 w. res.
R12, R18—5,600 ohm, 1/2 w. res.
R13, R20, R25, R26, R27—1 megohm, 1/2 w. res.
R14, R19—220,000 ohm, 1/2 w. res.
R22—4.7 megohm, 1/2 w. res.
R23—2.2 megohm, 1/2 w. res.
C1—.1 mfd., 400 v. cond.
C2—50 mmfd., var. air cond.
C3—100 mmfd., 50 v. elec. cond.
C4—.001 mfd., 200 v. cond.
C5, C14—500 mmfd., mica cond.
C6, C9, C12—.01 mfd., 400 v. cond.
C7, C10—.002 mfd., 400 v. cond.
C8—100 mmfd., var. air cond.
C11, C17—.005 mfd., 400 v. cond.
C13, C18, C19—.05 mfd., 200 v. cond.
C15, C16—.01 mfd., 200 v. cond.
S1—D.p.d.t. switch
CH1, CH2—2 hy. choke (Allied X60-801)
2—6SK7 tubes
1—6B8G tube

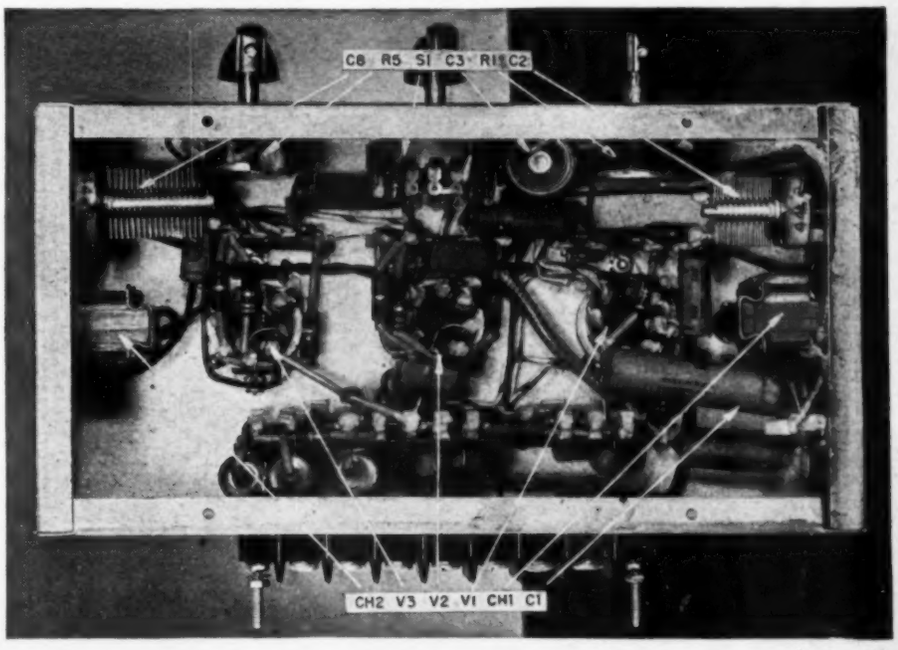
Fig. 2. Circuit diagram of the home-built Dynamic Noise Suppressor.

R^{11}-R^{12}. For any given frequency the attenuation produced by the degenerative signal on the plate of V^2 will vary with the adjustment of C^8 and the setting of R^5. The results obtained may be superior with lower values of R^{10}, or even eliminating it entirely, but the circuit will then be more critical with regard to tube replacement.

When a signal of sufficient magnitude to develop an appreciable voltage across

(Continued on page 184)

Fig. 3. Under chassis view showing location of important components.



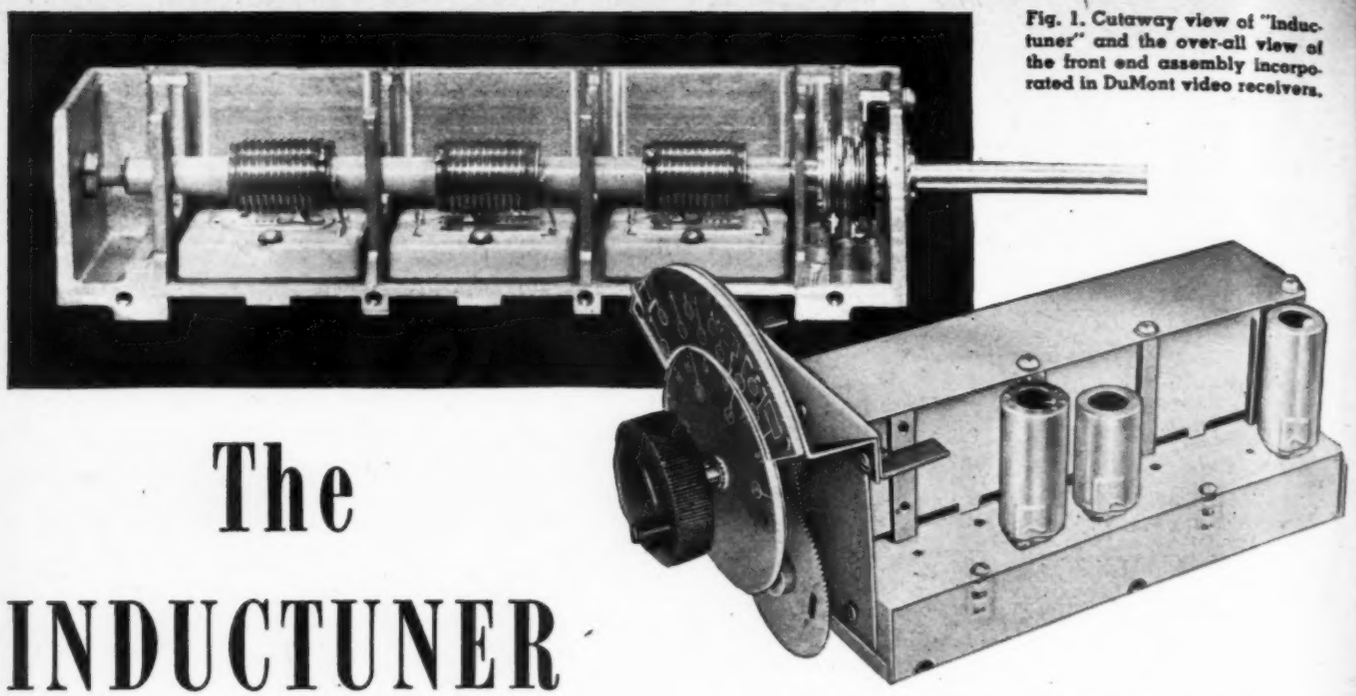


Fig. 1. Cutaway view of "Inductuner" and the over-all view of the front end assembly incorporated in DuMont video receivers.

The INDUCTUNER

Variable inductances providing wide tuning range (44-216 mc.) at high Q are used as tuning elements in front end assembly of DuMont video receivers.

THE proximity of the television channels to the FM bands makes it desirable to employ a tuner in television receivers which will enable users to receive the FM stations as well. One such tuner is the "Inductuner," designed by Paul Ware, manufactured by the *P. R. Mallory & Co., Inc.*, and used in *DuMont* television receivers.

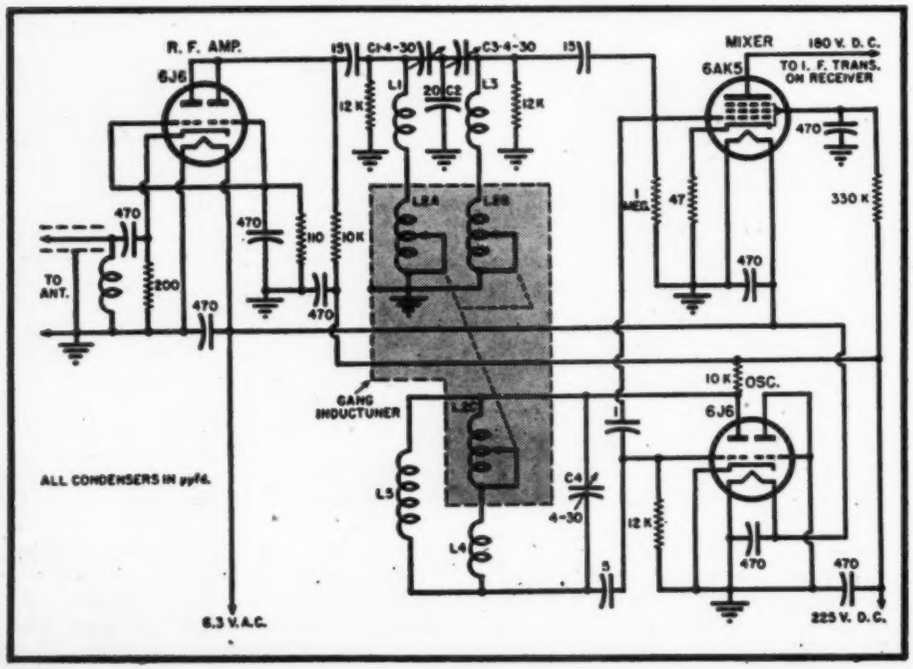
As shown in Fig. 1, the "Inductuner" consists of three separate variable inductances mounted on a common shaft. The coils are wound on ceramic forms and movable trolley sliders make contact at each point on the coil. Rotation of the shaft causes the inductance to vary from approximately .02 to 1.0 microhenry providing an inductance ratio of 1 to 50 and permitting a tuning range from 44 to 216 mc. It is generally true that the use of a variable inductance permits a wider tuning ratio than a variable condenser. This is because a length of wire and its inductance can be reduced to a smaller degree than the minimum capacitance of a variable condenser. Furthermore, as the inductance decreases, the losses reduce proportionately and it is even possible to have the losses decrease faster than the inductance, producing a rising *Q* with frequency. The important advantage of this is the rise in gain at the higher frequencies, something which is usually lacking in most receivers.

The movable trolley contact divides each coil into a used and an unused portion. As the trolley moves along, the low frequency end of the coil is shorted to the contact. This raises the natural frequency of the unused part and maximum occurs when the trolley is nearest the high frequency end of its travel. The upper frequency limit of the band over which this is to be used should be slightly lower than the highest frequency of the unused part. In this 10 turn unit, the natural frequency of the unused part is somewhat lower than 300 mc.

The equivalent diagram of one section of the "Inductuner" is shown in Fig. 3A. *Ch* and *Cl* are the stray capacitances from the variable inductance coil to the case, the latter generally being at ground potential. In shunt with the coil is a third capacitance *C* which consists of a fixed portion representing the interelement stray capacitance and a variable portion which is the distributed capacitance of the winding itself. As the trolley moves along, the active distributed capacity changes and eventually becomes a minimum when the trolley has reached the end of its run. Note that it is not necessary to use the full ten turns of the coil. The internal stop mechanism can be set so as to restrict

(Continued on page 130)

Fig. 2. Circuit diagram of the r.f. stages of DuMont television receivers.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

BARNEY IS PROMOTED

"HOW is that one, Mac?" Barney asked as he set a gleaming radio chassis on the end of the bench.

Mac dropped his soldering iron in the holder and looked the freshly-cleaned chassis over critically.

"Not bad, Barney; not bad at all! In fact, you have been doing such a good job in the cleaning department this past month that we are going to have to give you a little promotion. It is time you learned how to replace parts. Now is a good time to start, too, for this set I've been looking at is an example-and-a-half of how not to do it."

He turned the set on which he had been working upside down and pointed an accusing finger at a tubular electrolytic that had been bridged across an inverted-can condenser.

"There, my red-headed friend, is something I never want to see you do," he warned.

"You mean to replace a tin can condenser with a paper one?"

"The words are 'inverted can' and 'tubular electrolytic,'" Mac said reprovingly. "In learning a trade, the first thing to do is to learn the language so that fellow-mechanics will know what you are talking about when you ask questions or try to explain something to them. That business of calling a particular radio part a thing-amajig or a doo-hickey is all right for a school girl, but it does not go around the shop."

"What is more," Mac went on, trying not to grin at Barney's crest-fallen appearance, "I was not objecting to the use of the tubular condenser. They are okay. In many instances, they make good and inexpensive replacements. The mistake was in not cutting out the bad condenser from the circuit. The lazy guy who did this simply soldered the new unit right across the old one."

"That's ungood, huh?"

"Very 'ungood!' An old condenser often has a low resistance. This low resistance shunted across the new condenser increases its power factor, and a condenser is one place where a high power factor is bad. What is worse, sooner or later the old condenser is likely to short out—as it did in this case—and then the customer has to pay two service bills for what should have been one job."

"But where do you tie all those wires that used to be soldered to the old condenser after you take it out?" Barney wanted to know.

Mac opened a drawer and picked up a handful of little one- and two-lug mounting strips. "You use these," he said. "Often you can place the mounting-angle beneath a nut, or you can solder it directly to the chassis. Then you can use the insulated lugs for holding the connections removed from the condenser."

"Is there anything else wrong in that set?" Barney asked.

"What do you think?" Mac quizzed with a sidelong glance.

Barney's red head bent over the set as he inspected it gravely. "Wel-l-l," he offered cautiously, "the terminals on that gadg—I mean that volume control seem to have an awful lot of solder on them."

"Good!" Mac said. "I hoped you would notice that. And let me show you something else."

Picking up his soldering iron, he touched it to the lumps of solder on the volume control terminals. As he touched each one, the wires attached to it dropped off.

"The fellow who put in that control must have been the world's laziest," Mac said disgustedly. "He did not take the trouble to attach the wires firmly to the terminals before soldering them. He just tacked them in place and then piled the solder on to cover up. That is breaking the first commandment of radio servicing: *Always make your joints mechanically secure before you apply the solder.*"

"I catch; that saves solder."

"It saves more than solder, Barney; it saves you from getting sets back. In radio work, solder is not used to hold things together. That is up the tinner's alley, and he uses a different kind of solder. Radio solder is intended for the sole purpose of making a good electrical connection."

As he talked, Mac was skillfully removing the caked solder from the terminals. He held the point of his iron below each terminal so that when the lump of solder melted it flowed down on the iron, and then he wiped it off on the wad of steel wool he kept in a holder on the bench for that purpose. When the terminals were clean, he inserted the proper wires in each, wrapped the ends tightly around with his sharp-nose pliers, and then clamped the wires tightly in place. As Barney watched him closely, he applied the bright tip of the iron to each for a few seconds before he touched the rosin-core solder to the connection. The instant the solder touched the heated wires it flowed smoothly over them in a thin, seamless coat.

"It takes just two things to make a good soldered connection," Mac explained. "One is clean, bright surfaces; the other is plenty of heat. Most

(Continued on page 196)

JOHN T. FRYE

Born 1910, near Weiner, Arkansas, moved to Logansport, Indiana in 1924, attended Logansport High School, continued his studies at Indiana, Chicago, and Columbia Universities.
Has been in radio servicing since 1928. Started with a battery tester, a soldering iron, and a confident look. Secured amateur license W9EGV in 1932 and radio has since remained an avocation as well as a vocation.

TROUGH LINE TUNER for V. H. F.

By WARDELL H. SMITH,

The design and construction of a highly efficient r.f., mixer, and oscillator tuning system. Covering the frequency range from 78 to 153 mc., it includes the FM broadcast and 2-meter amateur bands.

LUMPED constants employed as tuned circuits in the form of coils and condensers become increasingly inefficient and difficult to handle as the resonant frequency of the combination increases. The limit of efficient operation for coils and condensers is in the neighborhood of 50 or 60 megacycles. When dealing with higher frequencies than these the size of the circuit elements—that is, capacity and inductance—becomes very small in proportion to the length of the connecting leads, making it difficult to confine the r.f. energy to the desired paths.

The problems of shielding the various components in such a manner that there will be no ground loops or feedback paths become more complex.

The use of coaxial lines as tuning elements solves all of these difficulties, but results in a system which is mechanically difficult to construct.

A very efficient, but relatively little known method of v.h.f. tuning is the trough line. The trough line, briefly, as can be seen by the drawings, consists of a central conductor, surrounded on three sides by a metal plate, one side remaining open. The *Q*, or factor of efficiency, of this type of line, when used as an inductance in a resonant circuit, is several hundred times as great as an equivalent coil and condenser, although not quite as good as a full coaxial line.

The front end for v.h.f., whose construction is described herein, gives a performance several times better than any similar piece of apparatus that the writer has yet seen. Its tuning range is from 78 to 153 megacycles, covering the standard FM broadcast band and the 144 megacycle amateur band. It is built of parts obtained at surplus together with components constructed by sheet metal bending.

The first 6AK5 tube is employed as an r.f. amplifier. This stage of amplification has a voltage gain of a little better than 25 at the low frequency end of the tuning range and 32 at the high frequency end of the range.

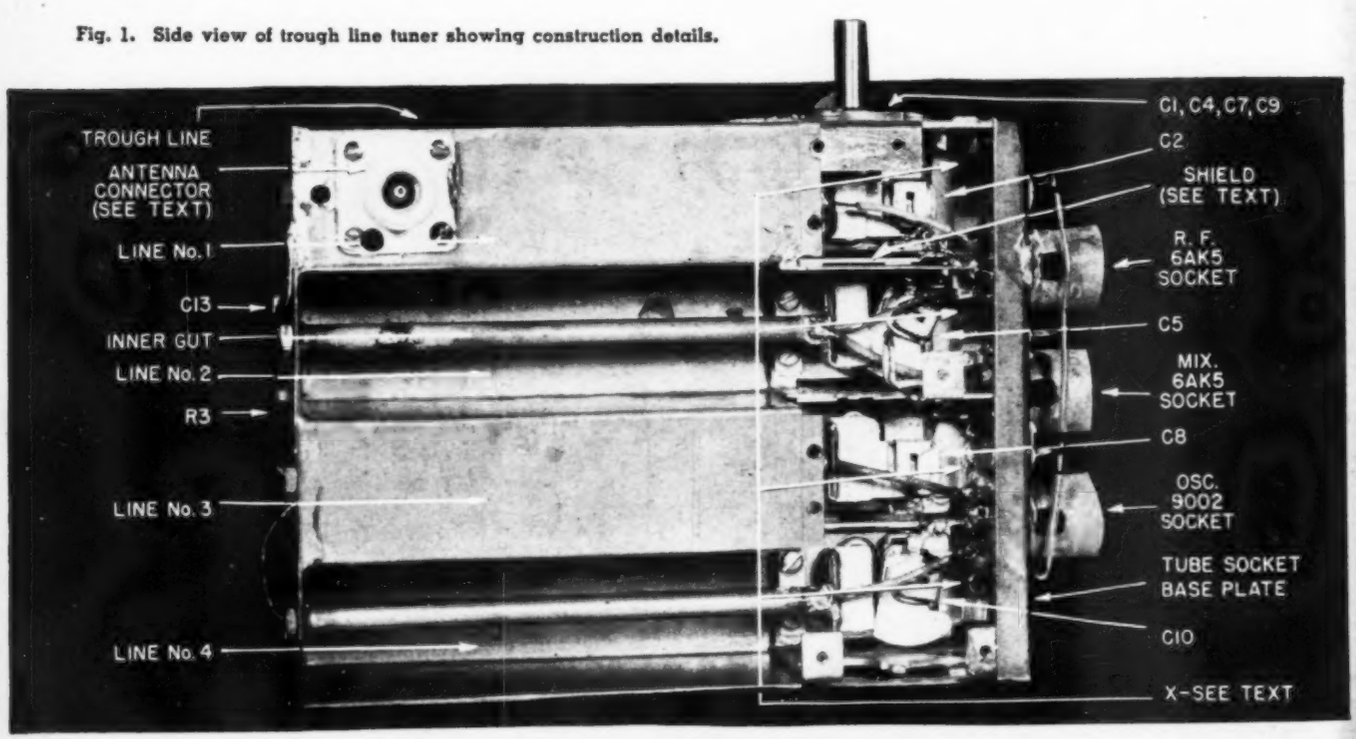
This apparent inconsistency with the usual state of affairs is explained by the fact that although the efficiency of the tube falls off slightly at the higher frequencies, the *Q* of the tuned circuit increases more rapidly, thus offsetting the decrease in tube efficiency.

The next tube in the lineup is the mixer, another 6AK5. This tube gives a gain of 8 at the lower frequency and approximately 10 at the higher frequency. No signs of instability or regeneration are present in the r.f. and mixer stages and they can be adjusted to track exactly throughout the entire tuning range.

Another very interesting feature of this tuning unit is the oscillator section. As can be seen by an examination of the diagram, it is a tuned plate, tuned grid oscillator; a circuit which has a great deal of merit but which has not been widely used of late. This circuit adapts itself beautifully to the trough line construction. For the oscillator with a trough line for grid inductance and a trough line for the plate inductance, a very high degree of stability is obtained, due to the high *Q* of the trough lines. In this tuning unit, *Q* is about 1500 as against 300 to 325 for the very best coil and condenser combination.

With the dimensions shown, the oscillator will track for an i.f. frequency of 10.7 megacycles. If it is desired to employ an i.f. frequency of between 4 and 5 megacycles, a 10

Fig. 1. Side view of trough line tuner showing construction details.



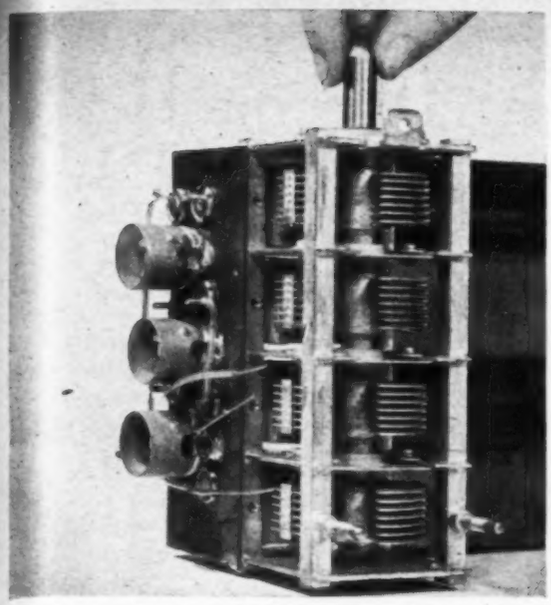


Fig. 2. Top view of trough line tuner. Note position of tube sockets and button mica condensers.

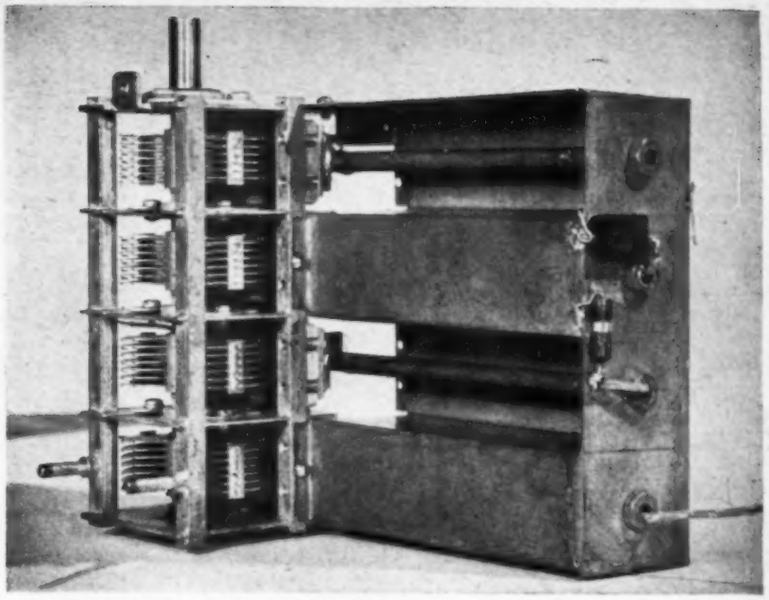


Fig. 3. Under chassis view. The resistor is R_3 and condenser is C_{13}. Wire emerging from "inner cut" line #4 (bottom) is connection "B+."

μμfd. fixed condenser should be connected between the grid and plate of the oscillator tube.

The entire unit is constructed around a 4-gang tuning condenser which was obtained in the surplus market. This condenser is of the split-stator, floating-rotor construction, and has a ceramic shaft and ball bearings. It has 90 degree rotation and a minimum capacity per section of 8 μμfd. and a maximum capacity of 38 μμfd. per section. The two outside rotor plates of each section have a number of small slots running almost all the way to the hub, which greatly facilitates alignment. These condensers may be obtained from several surplus sources, among them *Sherwood Associates,* Box 327, Jackson Heights, N. Y.

In order to start construction of the unit, obtain a piece of half hard brass or copper 13" long, 7⅛" wide and 1/32" thick. Cut the bend as shown in Fig. 6. Obtain another piece of the same material 4 15/16" long and 1⅝" wide and drill as shown in Fig. 6. Assemble these two plates to the tuning condenser, as shown in Fig. 1, soft soldering all points of contact.

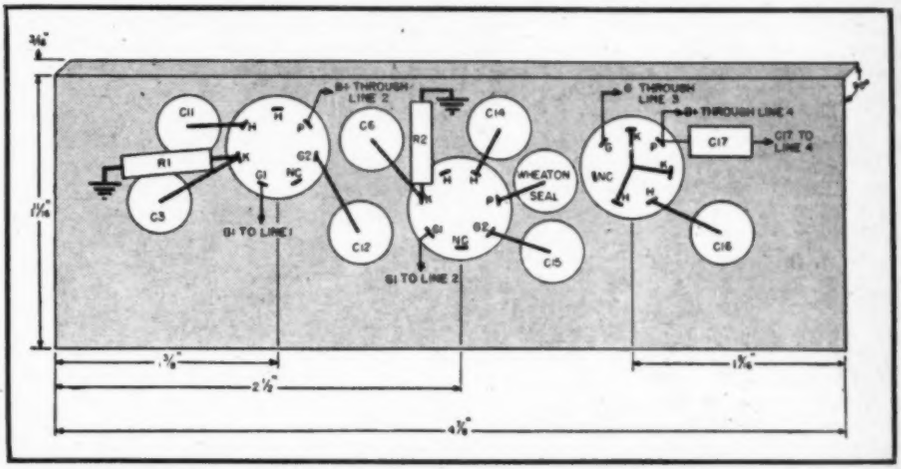
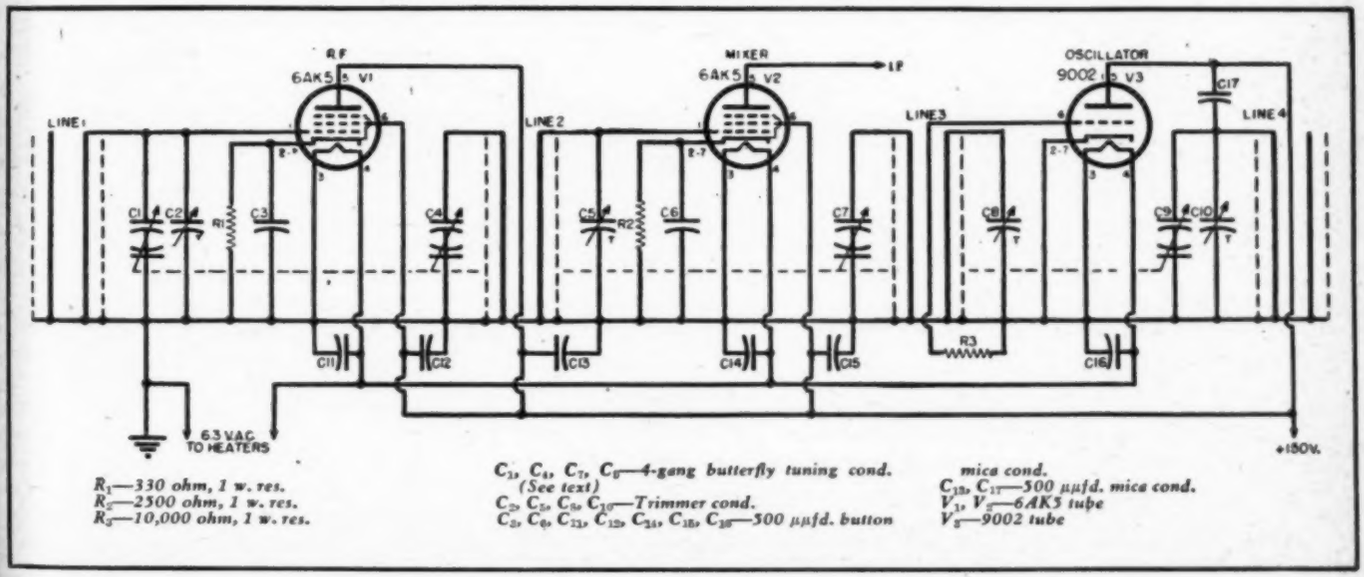


Fig. 4. Tube socket base plate shows relative position of component parts.

The tubes and button mica condensers are assembled on a plate which is drilled in accordance with

(Continued and page 174)

Fig. 5. Complete schematic diagram of the trough line tuner.



R_1—330 ohm, 1 w. res.
R_2—2500 ohm, 1 w. res.
R_3—10,000 ohm, 1 w. res.

C_1, C_4, C_7, C_9—4-gang butterfly tuning cond. (See text)
C_2, C_5, C_8, C_{10}—Trimmer cond.
C_3, C_6, C_{11}, C_{12}, C_{14}, C_{15}, C_{16}—300 μμfd. button mica cond.
C_{13}, C_{17}—500 μμfd. mica cond.
V_1, V_2—6AK5 tube
V_3—9002 tube

A Universal A.F.-R.F. WATTMETER

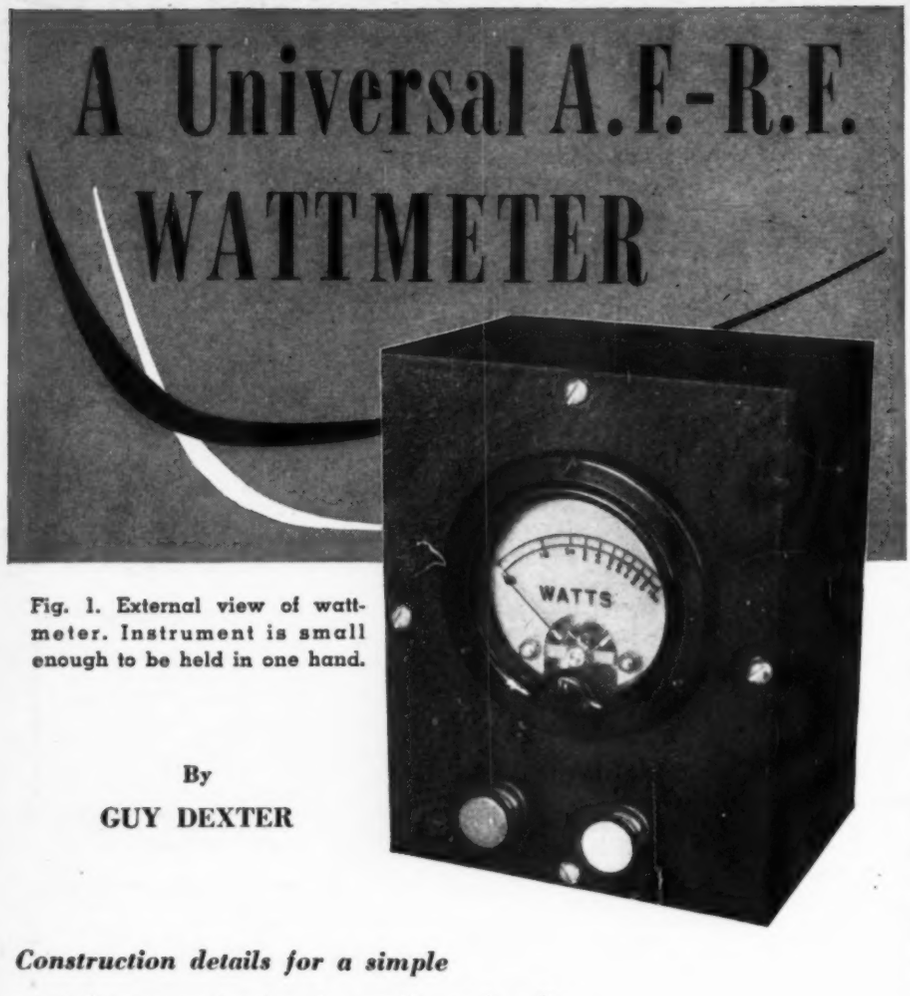


Fig. 1. External view of wattmeter. Instrument is small enough to be held in one hand.

By

GUY DEXTER

Construction details for a simple crystal type wattmeter for audio and radio frequencies. Instrument is a direct-reading unit.

THE busy radio technician should be able to measure watts as easily as volts, milliamperes, and ohms. There is no doubt that a direct-reading output wattmeter is a useful addition to any test bench. If the instrument will measure radio-frequency as well as audio-frequency power, it will be equally useful in the transmitting station and radio shop. Wattmeters are not owned by more radio men chiefly because the manufactured instruments are costly. Furthermore, most available wattmeters are suitable only for a. f. measurements.

A few everyday applications of a direct-reading output wattmeter for a. f. and r. f. are measurements of (1) receiver power output; (2) p. a. amplifier output; (3) transmitter r. f. oscillator output; (4) exciter output; (5) complete transmitter output; (6) power output of such test instruments as a power-type r. f. signal generator or audio test oscillator; and (7) power output of industrial and scientific instruments and devices, such as r. f. heaters, supersonic generators, and diathermy machines. Obviously, there are many other applications too numerous to mention here.

The compact wattmeter described in this article may be made direct reading from ¼ to 100 watts a. f. or r. f. It is small enough in size to be held in one hand, and uses no tubes, batteries, or power supply. It does not have to be connected to the electric power line. All parts used in this instrument are standard components which are obtained easily at any radio store. The design is extremely simple, so that any radio man can duplicate the instrument without difficulty. If the builder takes the time to make a special meter scale, or to inscribe wattage figures on the regular scale of the milliammeter used in this instrument, reading the wattmeter will be a simple operation.

Operating Principle

The wattmeter shown on these pages operates on the simple principle of determining power in watts from a voltage drop across a known resistance. The resistance is connected to the output terminals of the power-delivering device, such as an amplifier or oscillator, under test. The power (in watts) in such a test circuit is equal to the square of the voltage (E^2) divided by the resistance (R). Basically therefore the instrument is an a.f.-r.f. voltmeter operated in parallel with a standard resistor of constant ohmage. An a.c.-type vacuum tube voltmeter usually is employed for this purpose.

Here is an example of the voltage method of determining power output: A certain amplifier has an output impedance of 500 ohms. We connect a 500-ohm, non-inductive load resistor temporarily to the amplifier output terminals in place of the loudspeaker or line, and connect an a.c. voltmeter (one which has good frequency response) in parallel with the resistor. We then apply a sine-wave audio signal to the amplifier input terminals and adjust the amplifier gain controls for maximum undistorted output. We read the output voltage (E) which is set up across the 500-ohm resistor (R). Let us say this voltage is 5. The power output in watts (P) then is determined from the formula $P = E^2/R$. In this case, $P = 5^2/500 = 25/500 = 0.05$. The power output therefore is 0.05 watt or 50 milliwatts.

From the preceding discussion, it is easily seen that if R is made 1 ohm, the denominator of the E^2/R fraction becomes 1, and one calculation (division) is eliminated. Moreover, if the voltmeter scale is graduated in *volts squared* instead of volts (that is, marked off to read say 1, 4, 9, 16, 25 instead of 1, 2, 3, 4, 5), *all* calculations are eliminated and the voltmeter reads directly in watts.

These last operations simplify considerably the job of reading watts output by the voltmeter method. A direct-reading wattmeter is produced, but in this form the instrument is accurate only when the output impedance of the amplifier or other device under test is 1 ohm. Many various output impedance values from 1 ohm to several thousand ohms are encountered in practice and a universal wattmeter must be able to match any of these values, not just 1 ohm alone.

One simple scheme for impedance matching over a wide range of values results in the instrument circuit shown in Fig. 2. Here the voltmeter (reading in watts) is connected permanently across the 1-ohm resistor, R^2. Enough extra resistance, represented by R^1, is added in series to bring the total resistance $R^1 + R^2$ up to equal the output impedance of the device under test. Thus, when we must match a 100-ohm output, we make R^1 99 ohms. $R^1 + R^2$ then equals $99 + 1 = 100$ ohms. Addition of the external resistance will not disturb the watts calibration of the meter scale. Whenever power measurements are to be made in conjunction with a 1-ohm impedance, R^1 is made zero—that is, terminals A and B (Fig.

2) are short-circuited temporarily for the test.

If R^2 is made 1 ohm, we see (from the basic E^2/R formula) that a 0-10-volt meter range will indicate 0-100 watts when R^1 equals zero. For all other values of R^1 (corresponding to similar values of output impedance), the wattage indications must be multiplied by $R^1 + R^2$. Thus; a ½-volt deflection of the voltmeter indicates ¼ watt when R^1 is zero. But when matching a 500-ohm output, $R^1 = 499$ and $R^1 + R^2 = 500$. The same ½-watt deflection of the meter must then be multiplied by 500 and would indicate 125 watts instead of ¼ watt.

Complete Instrument

The complete a.f.-r.f. wattmeter circuit is given in Fig. 3. The simplicity of the instrument will be evident from this schematic and from the photograph, Fig. 1.

The indicating meter, *M*, is a regular 0-1 d.c. milliammeter. This meter, the 1N34 crystal diode, bypass condenser *C*, and calibration rheostat R^1 comprise a simple a.f.-r.f. voltmeter. Response of the voltmeter circuit is linear for full-scale voltages of 10 and higher, which makes calibration easy. The 0-10-volt range is used here. The voltmeter has excellent frequency response (negligible frequency error) throughout the audio spectrum and is useful up to several hundred megacycles.

The crystal voltmeter is connected in parallel with the 1-ohm, 100-watt standard resistor, R^2. Input terminals 1 and 2 are connected, in use, to the output terminals of the power-delivering device under test. Terminals 3 and 4 are connected to an external 100-watt load resistor, such as R^3 shown in dotted lines. The total resistance of R^2 plus R^3 must equal the output impedance of the device under test.

Provision is made for connection of an external load resistor, since it would be physically impractical to mount inside the instrument case enough fixed resistors, to be selected by a rotary switch, to take care of the multitude of output impedance values run across in practice.

Construction

The complete wattmeter (See Fig. 1) is built in a 4" x 5" x 3" metal box. This box is a standard item obtained at radio stores. A 2-inch milliammeter is employed in the author's instrument.

Input terminals 1 and 2 are seen directly below the milliammeter in Fig. 1. These terminals are heavy duty binding posts insulated from the metal box by means of polystyrene washers. Load resistor terminals 3 and 4 are on the left-hand side of the box and are not visible in Fig. 1.

The calibration rheostat, R^1, is a miniature 10,000-ohm wirewound unit with its shaft sawed off short and slotted for screwdriver adjustment. This rheostat is mounted on a metal bracket inside the instrument box. When the rheostat has been set, in the calibration process, it usually does not have to be touched again unless the crystal diode is replaced or the rheostat adjustment disturbed.

All wiring is done with rigid bus bar and connections are kept as short as possible. Since the wattmeter is intended for r.f. measurements, sharp corners and coiling in wiring must be avoided. Adequate clearance must be provided between the input terminals and the metal panel by making large clearance holes for the terminal screws to pass through. This will eliminate short-circuit (grounding) hazards and will minimize shunt capacitances.

The crystal diode must be connected, by means of its own pigtail leads, between the rheostat and input terminal No. 3. *Correct polarity of both crystal and milliammeter must be observed.* Follow the polarity markings shown in Fig. 3.

It is not necessary to stick to the size and shape of meter case employed by the author. An individual builder may satisfy his own tastes concerning arrangement and size of his wattmeter. Some builders, for example, will prefer a sloping-front cabinet and may favor a 3-inch or larger milliammeter.

Adjustment and Calibration

Adjustment and calibration of the instrument are made easy by the linearity of the voltmeter circuit. Single-point calibration is all that is required.

To make the single adjustment: Disconnect temporarily one end of the 1-ohm resistor, R^2, and short-circuit terminals 3 and 4. Apply an accurately-known 10-volt r.m.s. signal to input terminals 1 and 2 and adjust rheostat R^3 for exact full-scale deflection of meter *M*. The rheostat setting will be determined by the conduction characteristic of an individual crystal. After this adjustment is made, remove the signal voltage source from terminals 1 and 2, remove the short-circuiting jumper

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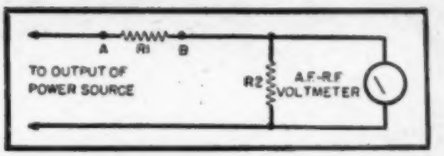
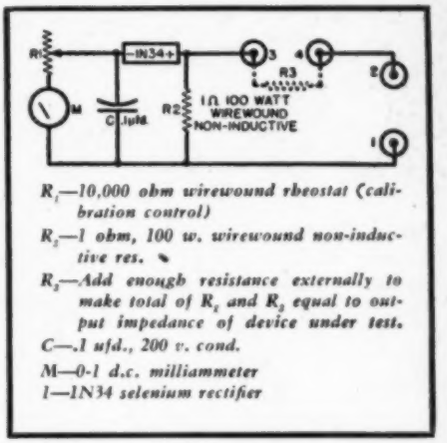


Fig. 2. Simplified circuit of wattmeter. Basic 0-100 watt scale of the meter is read when R_1 equals zero. For all resistance values multiply meter reading by sum R_1 and R_2. R_2 should be 1 ohm while the sum of R_1 and R_2 should equal the output impedance of the device under test.



R_1—10,000 ohm wirewound rheostat (calibration control)
R_2—1 ohm, 100 w. wirewound non-inductive res.
R_3—Add enough resistance externally to make total of R_2 and R_3 equal to output impedance of device under test.
C—.1 ufd., 200 v. cond.
M—0-1 d.c. milliammeter
1—1N34 selenium rectifier

Fig. 3. The a.f.-r.f. wattmeter circuit.

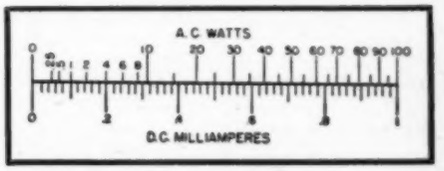
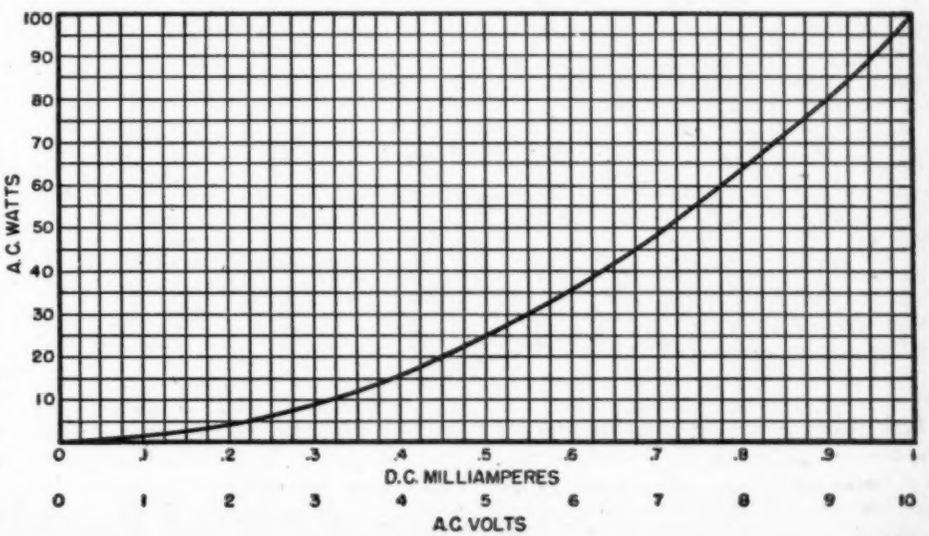


Fig. 4. Comparison of wattage and current scales. 1 milliampere equals 100 watts.

Fig. 5. Calibration curve of universal a.f.-r.f. wattmeter.



A REGULATED POWER SUPPLY

By D. H. ROGERS
Eng., Western Electric Co., Inc.

Design characteristics of a new, relatively simple shunt-type power supply regulator.

GOOD regulation is essential in power supplies furnishing plate power to high gain amplifiers, Class B amplifiers and stable oscillators, or bias to Class B and C amplifiers. In order to satisfy this requirement, the regulation of straightforward rectifier-and-filter supplies is improved by selecting heavy-duty, conservatively-rated components and arranging them in circuits which experience shows to be preferable. Mercury-vapor rectifiers, choke-input filters, and heavy bleeders are frequently used.

When better regulation is required than can be readily achieved by considering these factors, a series-valve regulator is sometimes selected. The basic circuit is shown in Fig. 1A. Here a tube, V_1, is connected in the positive lead so as to form a valve which controls the output by means of the voltages applied to its grid. The grid is driven by a d.c. amplifier tube V_2 which picks up and amplifies any variations in the output voltage. V_1 then operates so as to correct these variations.

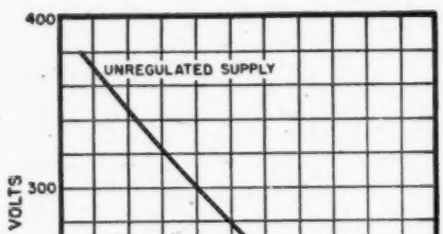


Fig. 2. Graph shows regulation obtained by means of new circuit shown in Fig. 1C.

In detail, the grid of V_2 is normally slightly negative, at a potential equal to the difference between the drop in the negative portion of the bleeder, which applies a large positive voltage, and the slightly larger negative voltage of the bucking battery. A large fraction of any increase in output voltage therefore appears on the grid of V_2, and produces an increase in plate current. The increased drop across the load resistor R_1 causes the grid of V_1 to become more negative, thereby increasing its impedance to the output current and tending to reduce the output voltage.

Tube V_1 must be large enough to pass the full load current with low voltage drop, and to dissipate comparatively large amounts of power when the drop across it is high. A 2A3, 6L6, or 6Y6G is usually chosen for this service, or two of them in parallel. Tube V_2 may be any suitable voltage amplifier such as a 6SJ7.

In some designs the battery is omitted, and bucking obtained from the constant voltage drop across a gas discharge tube inserted in the cathode lead of V_2. The bucking battery affords slightly superior regulation and permits design for slightly lower output voltages, but it requires periodic replacement on a shelf-life cycle. The condenser shown in the diagram is used to feed back all hum appearing in the output so that it will be degenerated. This action provides improved filtering.

A second common type of regulator works by shunt loss. In it the regulating element acts as a variable shunt, compensating for varying external load by presenting an alternate internal load, and increasing the load with higher line voltage so that the excess is taken up by internal drop. The most widely used shunt regulator is the VR type of gas-discharge tube, which shows a comparatively high voltage drop but very little change in drop with change in current. Or to put it the other way around, it requires a fairly high voltage to sustain a discharge but relatively small increases in voltage over this critical value will cause relatively large currents to flow. With these tubes, lumped resistance must often be added to increase the source impedance to the point where the current will remain within safe limits under the lightest load condition to be encountered. The basic circuit is shown in Fig. 1B.

Another way to obtain shunt regulation is to connect a battery of the proper voltage across the supply, usually a storage battery. Circuits may also be designed in which the shunt element is a vacuum tube controlled by a d.c. amplifier feeding back degeneratively any discrepancy between the output and a reference bucking voltage, in the same fashion as in the series circuits. One important advantage of shunt regulators over the series type is that they will pass a reverse current entering the supply from the load, with the same ease as a normal forward current. This characteristic makes them suitable for furnishing bias to tubes drawing grid current, whereas a series regulated supply will present an impedance equal to its bleeder under these conditions.

A new and comparatively simple shunt regulator circuit is shown in

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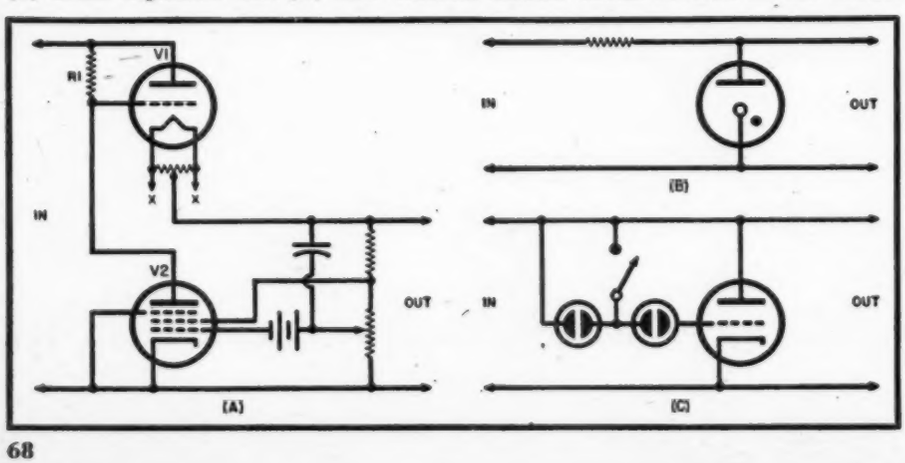
Fig. 1. Three methods that may be used for power supply regulation: (A) series type, (B) shunt regulator, and (C) new Western Electric circuit covered in this article.



360 Watt TRANSMITTER for PHONE or NBFM

By
R. N. PALMER, W2GSN
H. C. N. LONGACRE
Sylvania Electric Products Inc.

THE NEW 360 watt transmitter at W2GSN was designed to provide a compact unit for 10, 20, and 40 meter c.w., phone, or narrow-band FM transmission. Features of the transmitter include convenient switching; adequate metering for adjustment of all stages; rectified bias supplies to eliminate batteries; and facility for the adjustment of final tubes to normal ratings in all operating conditions. A pair of 3D24 tubes was selected as the final tubes for reasons of low driving power and no neutralization required.

The conventional circuit used, exclusive of exciter unit, is shown in Fig. 2. Front view of transmitter, which is housed in a cabinet 28" high, 14¾" deep and 22" wide, is shown in Fig. 1. Power pack including 807 supply at left, 3D24 supply at right and the small metal box housing the two bias supplies is shown at left in background of Fig. 6. Figs. 3 and 4 show side and rear views of the transmitter removed from cabinet.

The transmitter was designed for use with available low cost exciters such as the *Meissner* "Signal Shifter" and *Sonar* "FX" narrow-band FM unit. Operation may be switched from c.w. to plate modulation by means of S_3 shown in Fig. 2. This switch energizes No. 1 relay to open the plus lead of the 3D24 supply and add modulation transformer ahead of resistors R_6, R_7 and R_8. S_3 also energizes the No. 2 relay to cut out the c.w. self bias resistor, R_{11}, and cut in plate modulation self bias resistor, R_{12}. Since the 3D24 is a tetrode and linear modulation depends on linear variation of space current, both plate and screen must be modulated.

R_6, R_7 and R_8 serve as a power supply bleeder and also to feed screen voltage to the 3D24 tubes. R_7 is variable to provide close screen voltage adjustment for c.w. and phone. Linear variation of both plate and screen voltage is provided by placing the modulation transformer ahead of the three resistors. The filters L_4C_{12}, L_5C_{13}, placed in the 3D24 plate leads are tuned to 57 mc. to prevent television interference from harmonics of the fundamental frequency. This arrangement also helped on the fourth harmonic during 20 meter operation when television channel No. 2 was on the air.

Power supplies shown in Fig. 6 include bias providing correct voltage values for 807 and 3D24 grids for complete cut-off when excitation is removed. Voltage dividing resistors, which provide correct screen voltage for 3D24 tubes, are mounted beneath the compact chassis in such a way as to facilitate easy replacement of parts.

Figs. 3 and 4 show a side and rear view of the complete transmitter removed from its cabinet. All d.c. leads are electrostatically shielded. The final tank condenser is mounted on insulated blocks. Its rotor is grounded at the center to the common r.f. ground point for final tube filaments and screens. The 3D24 tubes are mounted in shielded wells, recessed to the bottom edge of their anodes. Recessing provides proper shielding for filament and grid leads. Holes provided in the wells allow a free flow of air over the tubes. The copper enclosure at right of the 3D24 tubes is a shielded box housing the 807 buffer amplifier shown in Fig. 7.

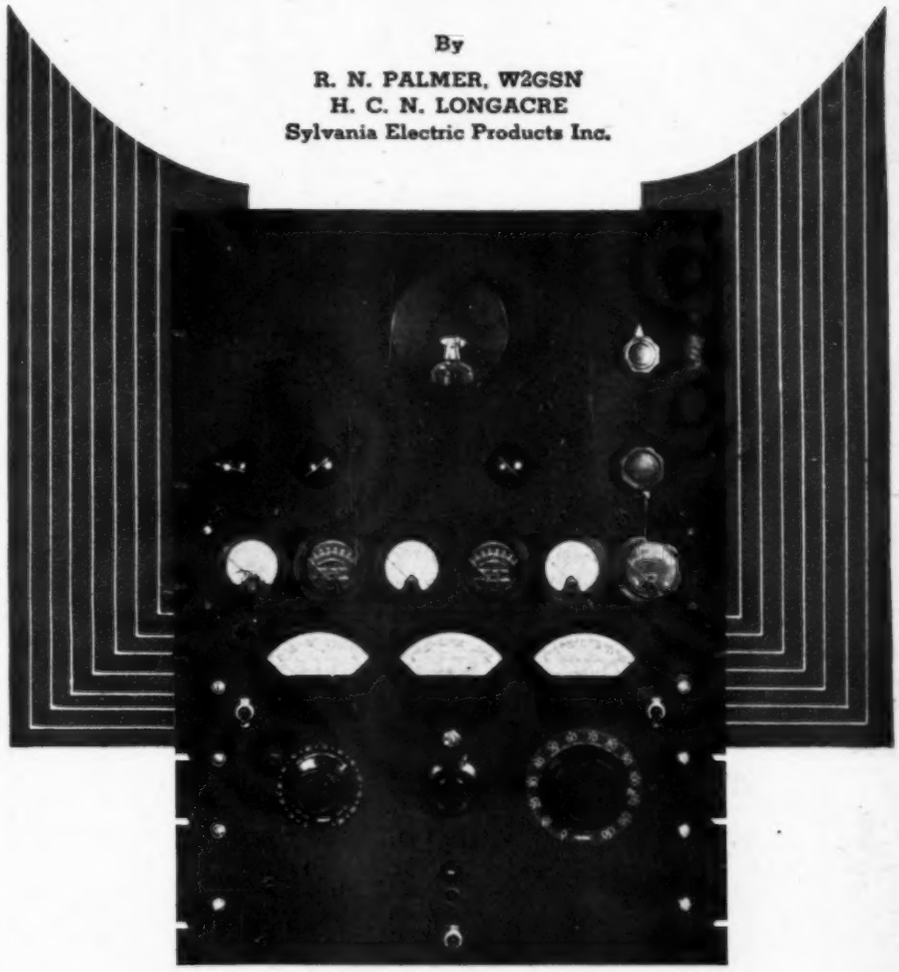


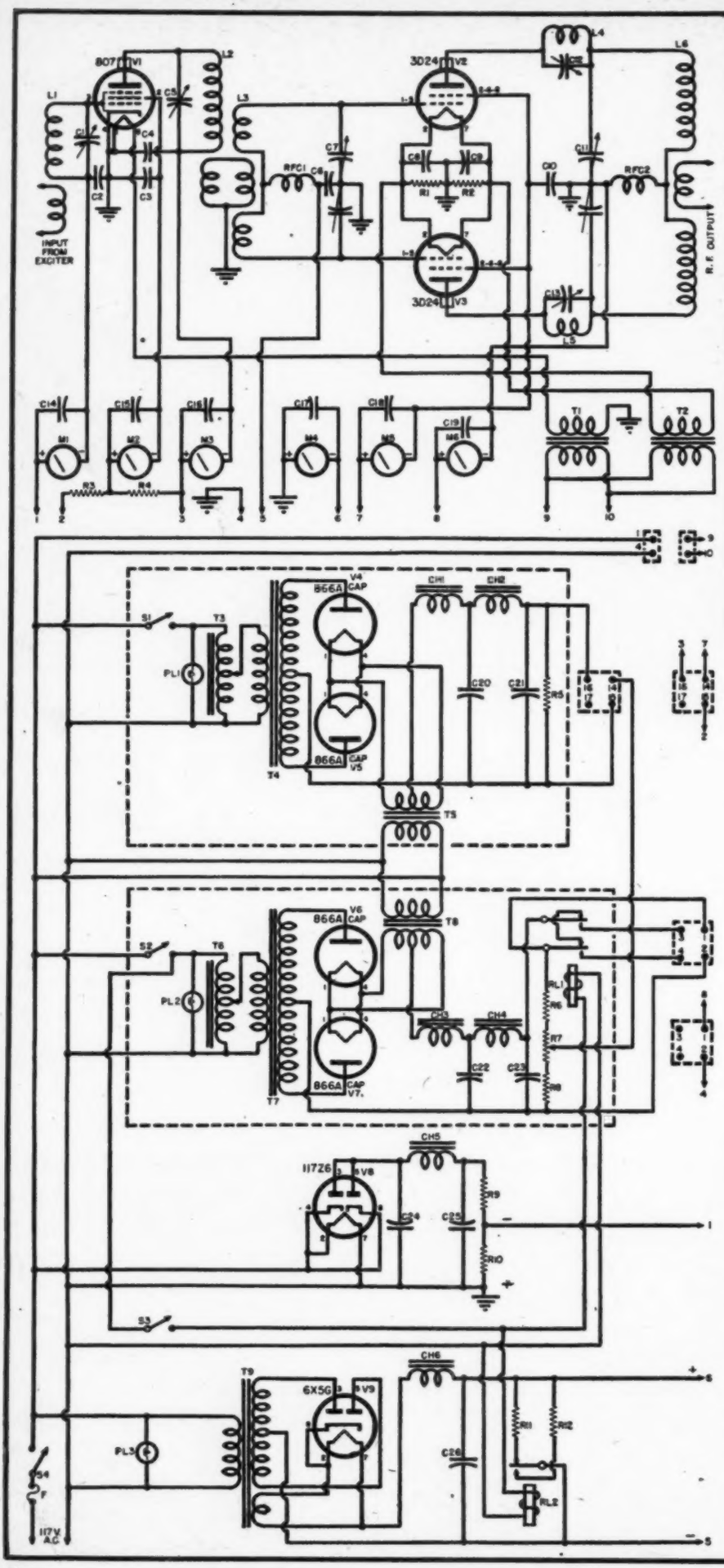
Fig. 1. Front view of W2GSN's 360 watt transmitter. Meters (left to right top row) are; buffer grid current, buffer screen current, buffer plate current, final grid current, final screen current, and final plate current. Meters (bottom row) indicate plate voltage and bias voltages.

Flexible, compact design for 10, 20, or 40 meter operation uses 4-watt exciter and eliminates need for neutralization.

The tuned grid stage is shown in the rear with a copper shield between the input and output stage. Coupling leads between the 807 output and 3D24 grids feed through the side wall to a point equidistant from each tube where the 3D24 grid coil is located, as shown in Fig. 5, a bottom view of the buffer and final amplifier chassis. Filament transformers for the 3D24 and 807 tubes are shown to the right. Shielding of the buffer and final stage is complete and neutralization is entirely unnecessary. Band switching is completely eliminated to keep the unit as small as possible and to eliminate switch contact trouble. All coils are easily accessible for quick band change. The 80 meter band, which has not been included in the design, can be easily accommodated by the insertion of a 25 mmfd. padding condenser across the grid and plate tank of the final stage.

The exciter unit, connected by 300 ohm line feeding through the upper left side of the cabinet, may be placed anywhere near the transmitter. Antenna connection is also made with 300 ohm transmission line passing through the upper right side of the cabinet. The modulator is connected by the large *Jones* plug shown at the lower left of the plate supply in Fig. 4.

A *Sonar* narrow-band FM exciter is used for both c.w. and phone and eliminates the need of a 180 watt modulator for phone operation. Final tubes are operated for narrow-band FM under the same conditions used for c.w., providing higher power output



than would be possible with plate modulation. If plate modulation is used, the secondary of the modulation transformer should be connected to pins 1 and 3 on the 4 prong plug.

Transmitter Adjustments

After a one minute filament warm up, the external driver stage is adjusted to the proper frequency. The 807 grid circuit is then tuned to resonance, indicated by a maximum deflection of its grid current meter. The 807 power supply adjusted to about 400 volts is then applied and the 807 plate tank condenser is adjusted for minimum dip of the 807 plate current meter. A signal voltage is now being supplied to the 3D24 grid coil and by tuning the 3D24 grid stage, resonance is obtained and is indicated by a maximum deflection of the 3D24 grid current meter. With the signal applied to the grids of the 3D24 tubes, the 3D24 power supply is switched on and adjusted to about 1000 volts. With loose coupling to the load circuit, the plate tank circuit should be tuned to resonance, indicated by a minimum deflection of the plate current meter. With resonance obtained, the load circuit is adjusted to draw 90 ma. plate current.

Fig. 2. Schematic diagram of 360 watt transmitter. Note that the new 3D24 tubes are used. These tubes have the advantage of low driving power and they automatically eliminate all neutralization problems.

R_1, R_2—5 ohm, 10 w. wirewound res.
R_3—25,000 ohm, 20 w. wirewound res.
R_4, R_5—20,000 ohm, 20 w. wirewound res.
R_6—27,000 ohm, 50 w. wirewound res.
R_7—10,000 ohm, 50 w. wirewound pot.
R_8—8,500 ohm, 50 w. wirewound res.
R_9, R_{10}—10,000 ohm, 2 w. res.
R_{11}—15,000 ohm, 10 w. wirewound res.
R_{12}—10,000 ohm, 10 w. wirewound res.
C_1—70 μμfd. var. air cond. (Johnson No. 70H15)
C_2, C_3, C_8, C_{19}—.002 μfd., 600 v. mica cond.
C_4—.002 μfd., 1000 v. mica cond.
C_5—70 μμfd. var. air cond. (Johnson No. 70H30)
C_7—100/100 μμfd. dual var. air cond. (Johnson No. 100HD15)
C_9, $C_{9'}$—.02 μfd., 400 v. mica cond.
C_{11}—100/100 μμfd. dual var. air cond. (Johnson No. 100DD70)
C_{12}, C_{13}—35 μμfd. var. air cond.
C_{14}, C_{15}, C_{16}, C_{17}, C_{18}, C_{19}—.01 μfd., 400 v. cond.
C_{20}, C_{21}—10 μfd., 600 v. oil-filled cond.
C_{22}, C_{23}—4 μfd., 2000 v. oil-filled cond.
C_{24}—1 μfd., 200 v. elec. cond.
C_{25}—16 μfd., 200 v. elec. cond.
C_{26}—16 μfd., 600 v. elec. cond.
L_1, L_2—10, 20, 40 meter coils, 75 w. (Bud OEL)
L_3—10, 20, 40 meter coils, 75 w. (Bud OCL)
L_4, L_5—9 t., No. 12 copper wire, ½ diam., 1 long
L_6—10, 20, 40 meter coils, 500 w. (Bud VLS)
PL_1, PL_2, PL_3—110 v. pilot light
M_1—0-15 ma. d.c. grid current meter
M_2—0-35 ma. d.c. screen current meter
M_3—0-100 ma. d.c. plate current meter
M_4—0-35 ma. d.c. grid current meter
M_5—0-100 ma. d.c. screen current meter
M_6—0-200 ma. d.c. plate current meter
RFC_1—2.5 mh., 150 ma. r.f. choke
RFC_2—2.5 mh., 500 ma. r.f. choke
RL_1—117 v., a.c., d.p.d.t. relay (Leach type 117C.B.F.)
RL_2—117 v., a.c., s.p.d.t. relay
T_1—Fil. trans., 6.3 v. at 3 amps. (Kenyon No. T351)
T_2—Fil. trans., 6.3 v. at 8 amps. (Kenyon No. T368)
T_3—110 v., 1 amp. Variac
T_4—Plate trans., 575-0-575 v. at 250 ma. (Kenyon No. T655)
T_5, T_8—Fil. trans., 2.5 v. at 10 amp. (Kenyon No. T352)
T_6—110 v., 5 amp. Variac (General Radio V5)
T_7—Plate trans., 2360-0-2360 v. at 300 ma. (Kenyon No. T670)
T_9—Power trans., 210-0-210 v. at 40 ma.; 6.3 v. 2 amps. c.t.; 5 v. at 2 amps. (not used) (Stancor P6289)
CH_1, CH_2—10 hy., 150 ma. filter choke (Kenyon No. T165)
CH_3—5-20 hy., 400-50 ma. swinging choke (Kenyon No. T516)
CH_4—10 hy., 250 ma. filter choke (G.E. K34J253)
CH_5, CH_6—10 hy., 60 ma. filter choke
S_1, S_2, S_3, S_4—S.p.s.t. toggle sw.
F—15 amp. fuse (Littelfuse 3AB)
1—117Z6 tube
1—6X5G tube
4—866A tubes
2—3D24 tubes
1—807 tube

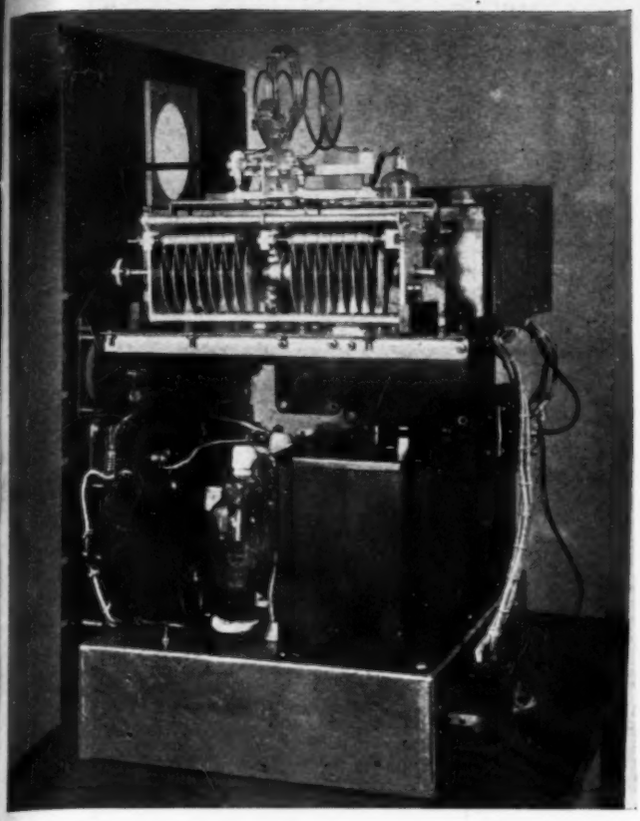


Fig. 3. Side view of transmitter shown removed from cabinet. The entire unit is housed in a cabinet 28 x 14¾ x 22 inches.

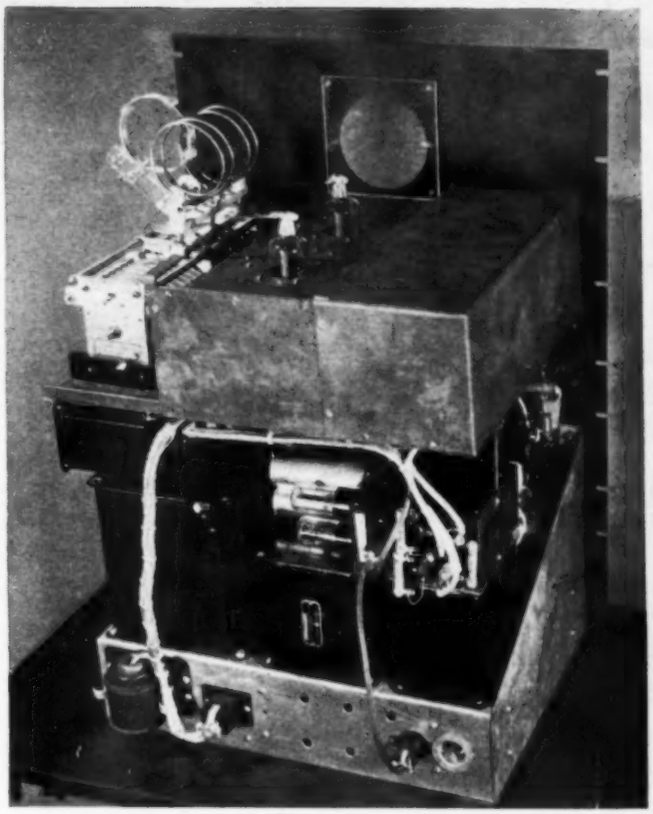


Fig. 4. Rear view of transmitter The small assembly lying on its side, under top chassis, is the bias supply pack.

The next step is to increase the 3D24 plate voltage gradually to 2000 volts making sure that plate current does not exceed 180 ma. Retuning the plate tank will be necessary as the load is increased. Screen voltage should be adjusted to 375 volts after the loading and plate tank are properly adjusted.

A slight readjustment of both the 807 and 3D24 stage will tune the transmitter to maximum efficiency. The final stage when properly tuned and adjusted for c.w. or narrow-band FM CCS conditions will show plate current at 180 ma. and grid current at 20 ma. when plate voltage is set at 2000 volts, the screen at 375 volts, and the developed grid bias is 300 volts.

For plate modulated phone, the transmitter is adjusted as described above except that plate voltage is adjusted to 1250 volts, screen to 300 volts for 140 ma. plate current and 20 ma. grid current with developed grid bias of 200 volts.

Chassis and Cabinet Arrangement

In the completed unit shown in Fig. 1 the lower panel and chassis holds all the power supplies, voltage controls, and voltmeters. At bottom center is the main switch for power to all filaments, bias supplies, and plate switches. A pilot light and fuse are mounted above. Switch for the 807 d.c. supply is at the extreme left below an indicating pilot lamp. Next is shown the d.c. voltmeter and Variac control for the 807 supply. The voltmeter for 3D24 screen voltage is located at center. Directly below is the switch for changing from c.w. or narrow-band FM to plate modulation. Below the switch is the 3D24 screen voltage control. Next is the 3D24 plate voltmeter and below, the plate voltage Variac control. To the extreme right is the 3D24 power supply switch and above it a pilot light indicator.

The upper panel and chassis holds the 807 buffer amplifier stage at left, with final 3D24 push-pull amplifier from the center to the extreme right. Metering is as follows: left to right, 807 grid current, screen current, and plate current meters; and 3D24 grid current, screen current, and plate current meters.

Tuning knobs for the 807 and 3D24 stages are above the current meters. Both 807 and 3D24 stages are tuned plate, tuned grid circuits. Starting with the tuning knob at left are knobs for 807 buffer amplifier tube grid and plate. Next, are the tuning knobs for the grid and plate for the 3D24 final ampli-

(*Continued on page* 128)

Fig. 5. Bottom view of buffer and final amplifier assembly.

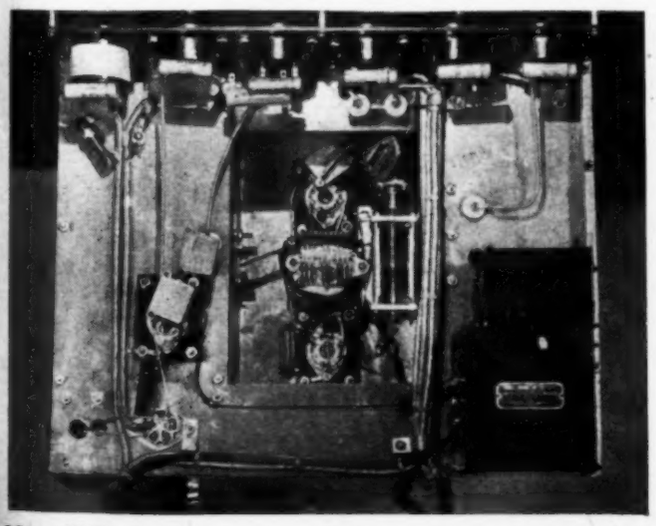
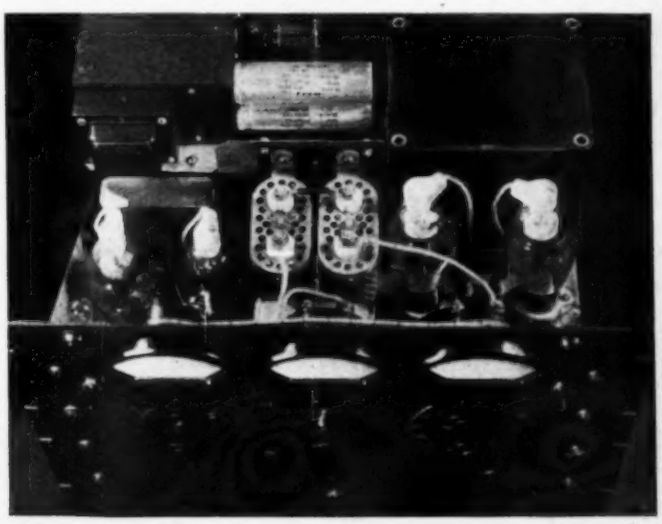
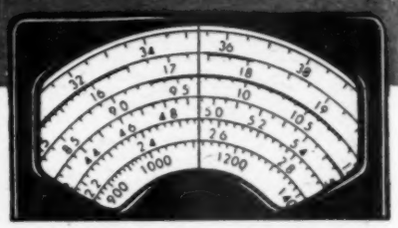


Fig. 6. Top view of power unit shows position of components.



International SHORT-WAVE



Compiled by **KENNETH R. BOORD**

THIS month we are happy to salute HCJB ("Heralding Christ Jesus' Blessings"), "The Voice of the Andes," located in Quito, Ecuador, South America, the *pioneer missionary broadcaster of the world.*

As the silver wings of *Panagra* flash over the heart of the Andes, one sees the rugged form of old Mount Pichincha looming to the north of Quito. On the lower slopes of this extinct volcano, the plane passenger sees one particular spot of green on which cluster several buildings and a radio tower. *That is HCJB!*

The visitor to Quito who takes the time to stop in at "The Voice of the Andes" sees abundant evidence of the present-day working of God. For HCJB is the outgrowth of a vision of *reaching the regions beyond by radio*—doing missionary work in many fields from one spot.

Here is the story of HCJB as related to me by Clayton Howard, its chief technician:

HCJB was founded in 1931 by two men—Clarence Jones and Reuben Larson. Mr. Larson had been a missionary in Ecuador for a number of years and had felt that *radio* could be of great value in missionary work. Mr. Jones had had a great deal of radio experience in religious broadcasting in Chicago, USA, but had felt a call to use *radio* in the mission field. While Mr. Larson was on furlough, these two men met and soon found that they had the same idea. They decided to see what could be done about it.

As soon as Mr. Larson returned to Ecuador, he approached the Government there and was able to secure a permit to operate a station for 25 years. Immediately, a 200-watt transmitter was purchased and was sent to Quito.

The city of Quito, capital of Ecuador, was chosen as the location although it is in the heart of the mountains at an elevation of 9500 feet and is about 12 miles south of the equator. Engineers had advised the use of Guayaquil, on the coast, as they said the mountains would affect transmission and that proximity to the equator would also be a distinct disadvantage. Nevertheless, Quito was chosen and both reasons given for "not" locating there have since been proved to be of great advantage.

The 200-watt transmitter was set up on a wavelength of 73 meters (4.107) and the first broadcast went out on Christmas Day, 1931. For the small group of missionaries gathered in the living room which served as studio in the HCJB home, the occasion meant much more than just another radio station "coming on the air." HCJB was the answer to years of faith and prayerful vision. Fervent and sincere were the grateful hearts that offered thanks to God for providing and preserving the fragile equipment that had been transported thousands of miles to bring to pass another chapter in the romance of modern missions!

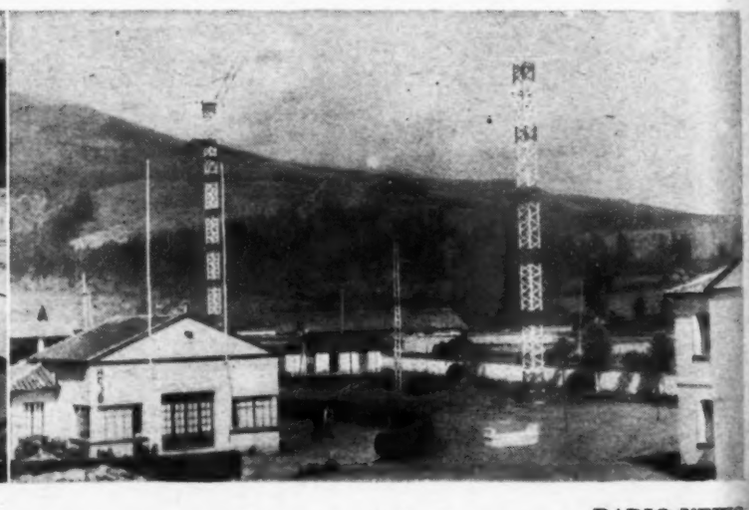
At that time, HCJB was the only station in Ecuador carrying regular programs, which makes HCJB actually the oldest station in that country. It is still the only station in the world owned and operated entirely by missionaries for the primary purpose of spreading the Gospel. Incidentally, at the time of the first programs, *there were only five or six radios in the entire country of Ecuador.*

From this humble beginning, HCJB has grown until it is what it is today. A station in the broadcast band (974 kcs.) soon was added to the original transmitter. In the spring of 1940, a new 10-kw. transmitter (12.455) was inaugurated by the President of Ecuador. At this time, the station moved to a new location (Inaquito) on the northern fringe of Quito. In 1942, a 30-meter channel (9.958) was added, and in 1943 wavelengths were added in the 19- and 49-meter bands (15.115 and 6.240). Just recently, 4.107 (73 m.) has been dropped, a *new* frequency of 5.995 (50 m.) has been added, and the use of 6.240 (49 m.) has been discontinued (at least for the time being).

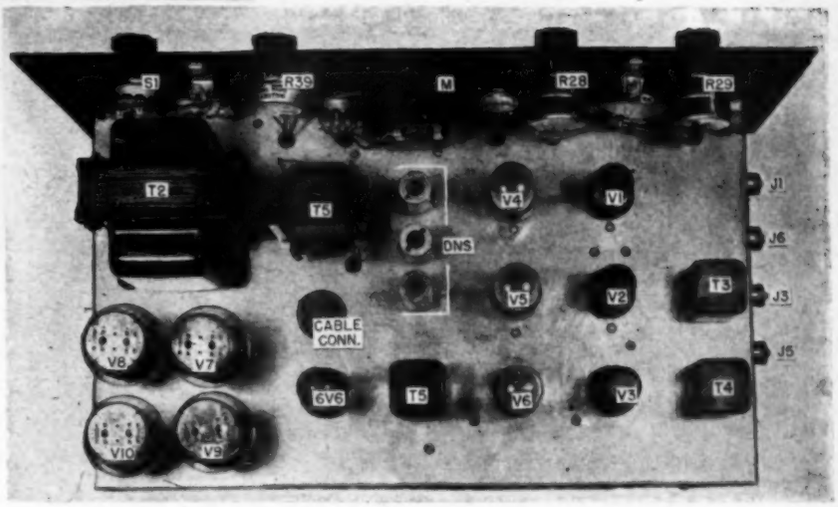
In the meantime, personnel has increased from the two original families until now there are some 26 full-time

(Continued on page 134)

(Left) Enrique Romero, one of the Ecuadorean operators, handling studio controls at Station HCJB. (Right) HCJB's transmitter building and antenna arrays at Quito.



Additional Notes on RECORDING AMPLIFIER



Top view of the improved recording amplifier showing location of important parts.

Improving the performance of the record-reproduce amplifier which appeared in the January 1948 issue.

THREE minor improvements have been incorporated in the original amplifier which have greatly enhanced its over-all performance. An increase in audio output (30 watts) has been made possible by employing fixed bias to the push-pull parallel 2A3's.

In order to supply the necessary bias voltage, an attempt was made to design a flexible circuit to meet this requirement. By employing selenium rectifiers in a full-wave circuit, the required bias is readily available.

Considerable hum reduction in the high gain preamplifier stages has resulted from the improved d.c. supply for the series filament string. A special transformer was designed (*Stancor* P-6349) which would not only provide 75 volts at 150 millamperes for the filaments, but would also supply the necessary 60 to 75 volts bias as previously explained.

By isolating this d.c. supply from a direct ground connection, which was not done in the original model, we eliminate the hazard of possible reversed polarity of the line supply in addition to reducing all traces of hum to a minimum. A 10,000 ohm, 50 watt adjustable voltage divided resistor makes it possible to adjust the ground point so that the plus 75 volt d.c. and the minus 60 to 75 volt bias may be set accurately to proper values.

A high fidelity output transformer (*Stancor* A-8060) was substituted for the A-7938 used in the original model. This unit is designed especially for fixed bias operation. By using fixed bias circuits, a power output of 30 watts at only 2.5% distortion is obtained without employing any feedback. This output is more than adequate to drive any high quality coaxial speaker system or magnetic cutter.

Isolating resistors have been inserted in series with each plate coming from the 12AH7 mixer tubes.

Dynamic Noise Suppressor

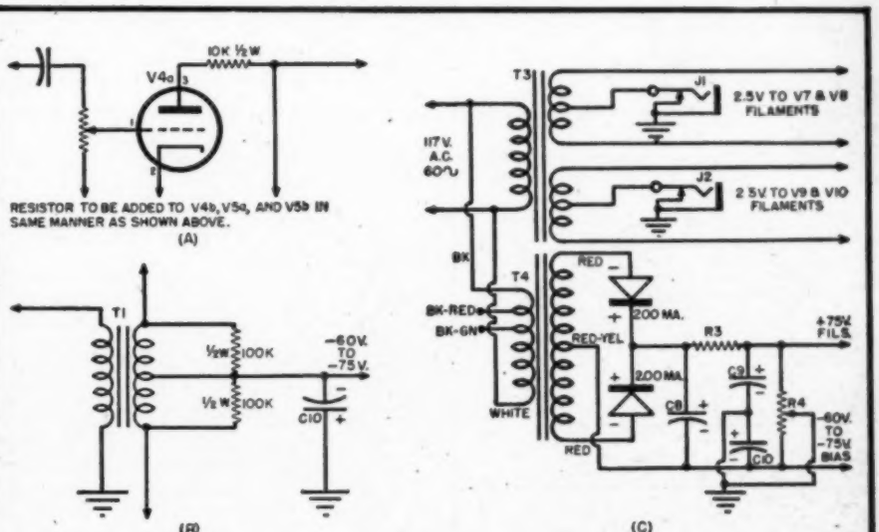
The original laboratory model was designed to include a three-tube Dynamic Noise Suppressor. Complete technical specifications were not available at the time of the original design. Later experiments were continued in an attempt to find a trouble-free circuit that would use a minimum of components. It was discovered that the two special chokes required in the Dynamic Noise Suppressor were subject to considerable hum pickup when incorporated within the amplifier proper and in the space provided. We therefore recommend the construction of a separate unit, as described in Part 15 of the recording series in this issue.

In answer to many requests for additional information on the name plates, these were made from regular printing cuts and were used simply to dress up the unit. Other suitable plates are, of course, to be found in most radio jobber catalogues.

Reference to the photograph will show

(Continued from page 144)

Diagram shows important changes which were incorporated in the new amplifier.



R3—500 ohm, 20 w. wirewound res.
R4—10,000 ohm, 50 w. wirewound res. with slider (adjust slider to give +75 volts on filaments as shown)
C9—40 mfd., 250 v. elec. cond.
C8—16 mfd., 150 v. elec. cond.
C10—50 mfd., 150 v. elec. cond.
T2—Output trans. for fixed bias (Stancor A-8060 or equivalent) This transformer is not shown on above diagram. It appears on the complete schematic covered in the January issue. This transformer should be used with the above revisions.
T4—Power trans. (Stancor P-6349)

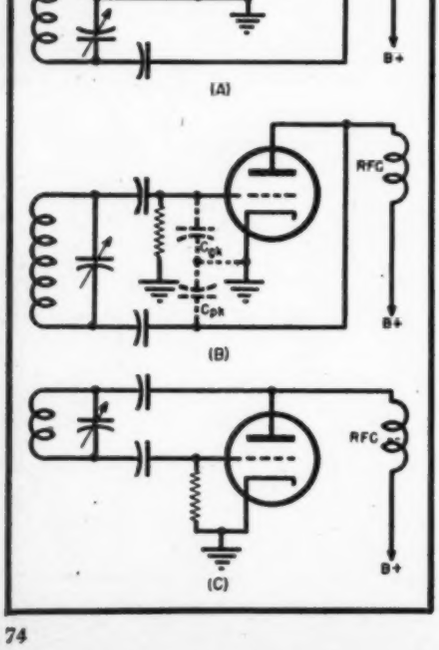
MODERN *Television* RECEIVERS

By MILTON S. KIVER

Photograph illustrating the assembly of the front end tuner employed in the RCA television receiver.

Part 2. A comparison of the design and operation of different oscillator circuits used in TV sets.

Fig. 1. Circuit diagrams show the similarities between the Colpitts (A) and the ultraudion (B) oscillators. The circuit diagram (C) illustrates how the ultraudion oscillator is usually drawn.



SINCE the television receiver is a superheterodyne, the incoming signal that was previously amplified by the r.f. stage is now ready to be converted to the lower i.f. value. Toward this end, the signal is transferred to a mixer stage where it is brought into electrical contact with the oscillator voltage.

Oscillator stability is one of the most important engineering aspects of television receivers and this is governed almost entirely by the FM audio signal. The signal spread of the FM audio signal is plus and minus 25 kc. and when this is compared to the 4.0 mc. of the video signal, it appears to be almost negligible. For this reason it is highly important that oscillator frequency drift be held to a minimum because even such a relatively small oscillator drift as .03 per-cent will, at 100 mc., shift the i.f. signal by 30 kc. or enough to produce a distorted sound output. To minimize drift, oscillators in television receivers are constructed as separate units, feeding their signal to the mixer by capacitive and/or inductive coupling.

Motorola Perhaps the most frequently employed oscillator circuit in current television receivers is the circuit shown in Fig. 1B. It is known as the ultraudion, and is equivalent in its action to the well-known Colpitts circuit. See Fig. 1A. In the ultraudion, the voltage division across the tank circuit is accomplished through the grid-to-cathode (C_{gk}) and the plate-to-cathode (C_{pk}) capacities within the tube. The feedback voltage which sustains oscillations is developed across C_{gk}. In *Motorola* Model VT 101 receivers, the oscillator stage has the actual form shown in Fig. 2A and the equivalent network indicated in Fig. 2B. The tank capacity consists of the effective capacity of C_{gk} in series with the parallel combination of C_{pk} and C_1, while C_T consists of the grid-plate capacity, C_2, and the distributed capacity. C_2 is a temperature compensating condenser and helps reduce oscillator drift. In spite of this, some drift does occur, hence C_1 is provided to permit the set user to adjust the oscillator frequency for the best sound output. Because C_1 is actually a vernier adjustment it is labeled "fine-tuning control" and placed on the front panel. Condensers C_3 and C_4 keep the d.c. plate voltage off the exposed coils. C_4 also makes it possible for the oscillator to develop grid-leak bias across R_1. A separate coil is brought in for each channel and each coil can be individually adjusted as to frequency. This is necessary because the oscillator frequency must be accurately set for each channel.

Modified Ultraudion In the Colpitts oscillator of Fig. 1A, it is entirely possible to shift the placement of the ground connection from the cathode to the plate end of the tank coil without affecting the operation of the oscillator. Now, however, we must provide a d.c. path from the cathode to ground, otherwise the tube electron flow will be

interrupted. For this, we can use an r.f. choke which provides the necessary d.c. path but still maintains the cathode at the required r.f. potential. The corresponding shift in ground point can be applied to the ultraudion circuit and an oscillator of this type is employed in *G.E.* Model 801 and *Motorola* Model VT 71 receivers. The actual circuits employed are shown in Fig. 3.

In the *Motorola* Model VT 71 circuit, "B+" voltage is actually fed to the grid and cathode of the oscillator, while a higher value of "B+" (indicated by "B++") is applied to the plate. Why this particular arrangement is employed here will be explained when we analyze the low-voltage power supply design of this receiver. For the moment, however, simply regard "B+" as equivalent to ground and "B++" as being some higher positive voltage. Since the grid and cathode receive the same positive potential from "B+", there is no voltage difference produced between them from this source and therefore it is of no consequence. Grid-leak bias, due to the circuit oscillations, is then developed across R_1 making the grid negative with respect to the cathode.

United States Television, in some of its models, employs an ultraudion circuit similar to the *Motorola* VT 101 set; in other models, *UST* reverts to the modified circuit shown in Fig. 3. The modified oscillator of Fig. 3 is also employed in *Belmont* receivers where we find continuous tuning. (Refer to Part 1 of this series.) The only important difference between a set having continuous tuning and one with a selector switch is the elimination of the fine-tuning condenser. Since the station is tuned in manually, oscillator frequency drift can be compensated directly by retuning the set. This is the procedure in *Belmont* receivers and, for that matter, in *DuMont* and *Industrial Television* sets, which also use a continuous type of tuner, the "Inductuner". See page 62 for details on the "Inductuner".

Still another variation of the ultraudion circuit is shown in Fig. 4A. This differs from the previous circuit in possessing the tuned circuit in its plate rather than its grid circuit. Grid-leak bias is developed by the 30 $\mu\mu$fd. condenser across the 6800 ohm resistor in the grid circuit. Grid current flows whenever the cathode assumes a potential which is more negative with respect to ground than the grid voltage present across the 30 $\mu\mu$fd. condenser. Actually, of course, this is equivalent to driving the grid positive with respect to the cathode, whereupon the grid draws current. This is similar to the action in any conventionally connected tube.

In this particular circuit, which is employed in all *Andrea* models, the tuning coil L_1 remains in the circuit at all times. To change the resonant frequency of the oscillator, additional condensers or coils are placed in parallel with L_1. The added components used for each of the thirteen channels are shown in Fig. 4B. A testing point is provided to permit servicemen to measure the oscillator grid-leak bias voltage without actually going into the "turret" tuner employed in *Andrea* models.

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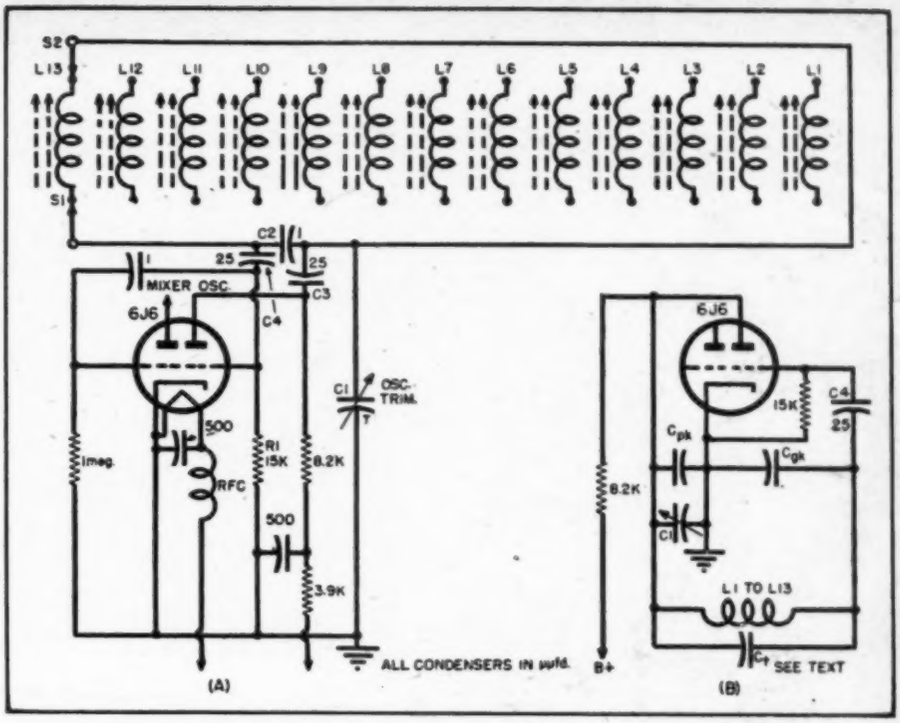

Fig. 2. The ultraudion oscillator arrangement (A) and its equivalent circuit (B) as employed in the Motorola VT101 console television receiver.

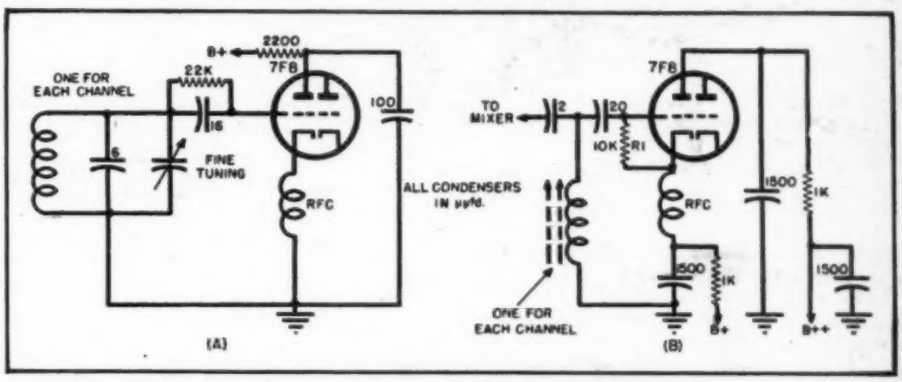

Fig. 3. Schematic diagram of the ultraudion oscillator circuits employed in (A) G.E. Model 801, and (B) Motorola Model VT71 television receivers.

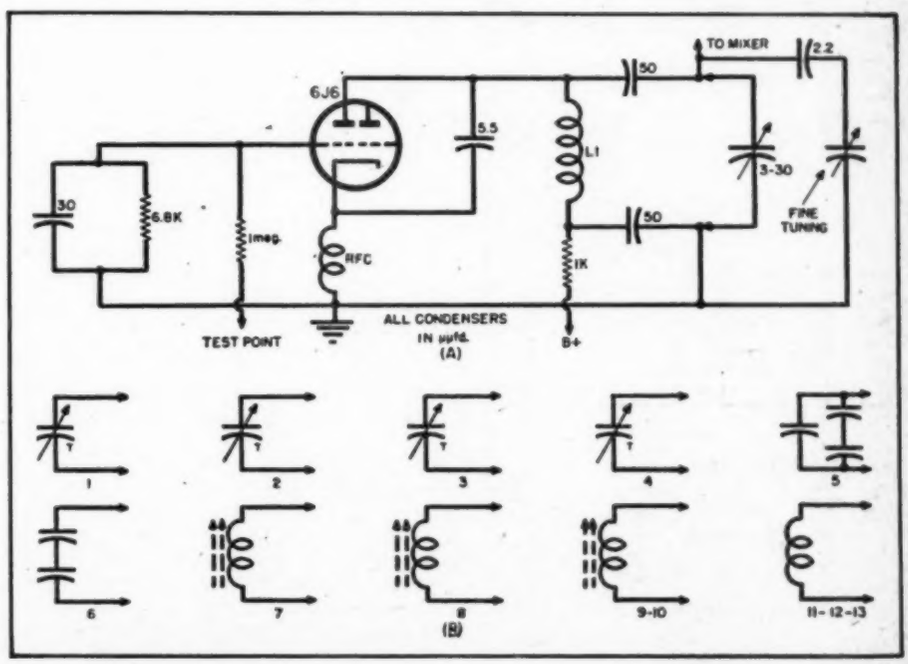

Fig. 4. (A) Circuit diagram shows another variation of the ultraudion oscillator circuit as used in the Andrea television receiver. (B) The various tuning arrangements that are brought into the oscillator circuit for different television channels used in the Andrea home receiver.

RCA Television Models The simulated quarter wave section transmission line tuner that *RCA* employs for their r.f. amplifier is also found in their oscillator circuit. See Fig. 7. The oscillator is actually a push-pull circuit with the r.f. plate voltage of one triode section feeding the grid of the other triode. The channel switch, as it progressively moves down the line, adds more and more inductance to the line, effectively lowering the tank frequency. For tuning each channel, brass screws are placed close to the high-frequency tuning straps L_{14}, L_{16}, L_{18}, L_{20}, L_{22}, L_{24}, and L_{26} and brass cores are adjusted through coils L_2, L_4, L_6, L_8, L_{10}, and L_{12}.

C_1 is a fine-tuning control which is connected across the entire tuning line. It provides a frequency variation of approximately plus or minus 300 kc. on channel 1, and this increases to plus or minus 750 kc. on channel 13. Coupling between the oscillator line and mixer line is accomplished by a single turn of link coupling and physically locating the oscillator line close to the converter grid line.

Table 1. A comparison of present-day television receivers. The chart below includes only those models which are on the market and which have been discussed in the articles thus far. As new models become available, they will be added to chart and adequate explanation of their operation given.

Manufacturer	Model No.	Picture Type: Direct	Picture Type: Proj.	Tube Size (diam.)	Screen Size	Model Type: Table	Model Type: Console	Tuning Method: Continuous	Tuning Method: Selector Switch	R.F. Amp.	R.F. Osc.
Andrea	T-VJ12	X		12	7½x10	X			X[1]	6J6	6J6
	C-VJ12	X		12	7½x10		X		X[1]	Same as Model T-VJ12	
	CO-VJ12	X		12	7½x10		X		X[1]	Same as Model T-VJ12	
Belmont	21A21	X		7	5½x 4¼	X		X		6AK5	6C4
General Electric	801	X		10	6 x 8		X		X	6AU6	⅓-7F8
	802	X		10	6 x 8		X		X	Same as Model 801	
Motorola	VT71	X		7	4½x 6	X			X	⅓-7F8	⅓-7F8
	VT101	X		10	6⅜x 8½		X		X	6AG5	⅓-6J6
Philco	48-1000	X		10	6 x 8	X			X	6AG5	6J6
	48-1050	X		10	6 x 8		X		X	Same as Model 48-1000	
	48-2500		X	5	15 x20		X		X	6AG5	6J6
RCA	621TS	X		7	4½x 5½	X			X	6J6	6J6
	630TS	X		10	6⅜x 8½	X			X	6J6	6J6
	721TS	X		10	6⅜x 8½	X			X	6J6	6J6
	630TCS	X		10	6⅜x 8½		X		X	Same as Model 630TS	
	721TCS	X		10	6⅜x 8½		X		X	Same as Model 721TS	
	730TV1	X		10	6⅜x 8½		X		X	Same as Model 721TS	
	730TV2	X		10	6⅜x 8½		X		X	Same as Model 721TS	
	641TV	X		10	6⅜x 8½		X		X	6J6	6J6
	8TS30	X		10	6⅜x 8½	X			X	Same as Model 630TS	
	648PTK		X	5	15 x20		X		X	6J6	6J6
United States Television	T-502	X		10	6 x 8		X		X	6AG5	6AG5
	T-507		X	5	21 x16		X		X[2]	6AG5	6AG5
	T-525		X	5	25 x19		X		X[2]	Same as Model T-507	
	T-530		X	5	30 x22½		X		X[2]	Same as Model T-507	
	T-621		X	5	22¼x16¼		X		X[2]	Same as Model T-507	
Admiral	30A14	X		10	6 x 8		X		X	6J6[6]	6J6[6]
	30A15	X		10	6 x 8		X		X	Same as Model 30A14	
	30A16	X		10	6 x 8		X		X	Same as Model 30A14	
Industrial Television Inc.	1T3R	X		See Note 3				X[7]		6J6	6J6
Du Mont	RA-101	X		See Note 4			X	X		6J6	6J6
	RA-102	X		12	7½x10		X	X		6J6	6J6
	RA-103	X		12	7½x10	Note 5		X		6J6	6J6

[1] The Andrea receivers employ a tuner "turret" which is somewhat similar to the Philco tuner except that all 13 channels are wired into position. The r.f., modulator, and oscillator tubes, with their circuit components, are also contained within the copperplated steel case. This reduces reradiation and protects the circuits from external fields.

[2] The r.f. tuning circuits of U.S.T. receivers closely resemble those employed in G.E. receivers. See explanation in Part 1 of this series.

[3] Industrial Television receivers are designed solely for commercial use. The picture tube is housed separately and controlled by a control unit located some distance away. Picture sizes can range from 6 x 8 inches for a 10 inch diameter tube to 12¾ x 17¼ inches for a 20 inch diameter tube.

[4] The set appears in six different style cabinets: Hampshire, Sherwood, Westminster, Revere, Plymouth, and Devonshire. Differences between models are in the size of the cathode-ray tube. The Hampshire and Westminster use a 20 inch tube; the other four models use a 15 inch diameter tube.

[5] This model receiver is available in three types of cabinets, two of which are table models and one is a console.

[6] Models 30A14, 30A15, and 30A16 employ an r.f. end section which is very similar to the RCA front end system.

[7] Industrial Television employs the "Inductuner" in an arrangement similar to that found in DuMont receivers.

Philco Receivers *Philco* television circuits employ an oscillator which at first glance appears to be similar to one of the preceding ultraudion oscillators. This much is true. See Fig. 5. However, further examination reveals that the second triode of the 6J6 is also connected across the oscillator and therefore would affect its operation. This second tube is known as a reactance (or control) tube and through its effect on the oscillator, the circuit is enabled to counteract any reasonable shift of oscillator frequency. Here, then, is an automatic system for keeping the oscillator on frequency, thereby removing the need for a fine-tuning control.

In order to understand and appreciate the operation of this reactance tube let us determine how a tube can simulate the action of a resistance, a capacitance, or an inductance. In Fig. 6A, a tube is connected with normal plate and grid voltages, so that plate current is flowing through the tube. When we increase the plate voltage, the plate current will increase and the two will follow each other directly within fairly wide limits of plate current flow. The same is true of a plate voltage decrease; the current will decrease in step. Since the two follow each other directly, we obtain essentially the same action as the voltage and current in a resistor and consequently the tube is functioning as a resistor, although at some points, as a nonlinear resistor.

Now, let us alter the circuit to the form shown in Fig. 6B. A source of r.f. voltage is connected to the plate of the triode and the "B+" voltage now reaches the tube through an r.f. choke. The choke prevents the r.f. plate current from traveling through the d.c. voltage source. In the same circuit, a small capacitance and resistor transfer a portion of the r.f. voltage to the grid of the tube. Let us investigate this section of the circuit more closely.

Since C_1 and R_1 are placed directly across the r.f. voltage source, an r.f. current will flow through both components, the amount of current being governed by the impedances of C_1 and R_1. In the diagram it is specified that C_1 is small, resulting in a large impedance. The resistor, on the other hand, is low in value. Thus the circuit impedance will be largely capacitive and the current flowing through C_1 and R_1 will lead the r.f. voltage by approximately 90 degrees. The r.f. current, flowing through R_1, will develop a voltage e_g which is in phase with the r.f. current and leading the r.f. voltage from the generator by 90 degrees. It is further true that since e_g is also the alternating grid voltage for the tube, the plate current will lead the applied r.f. voltage by the same 90 degrees. Whenever any electrical component exhibits the property of having the current through it lead the voltage applied across it by 90 degrees, it is said to act like a capacitance. Thus, by properly connecting the tube, we have made it appear to the circuit as a condenser. The tube will have this effect on any circuit in which it is placed.

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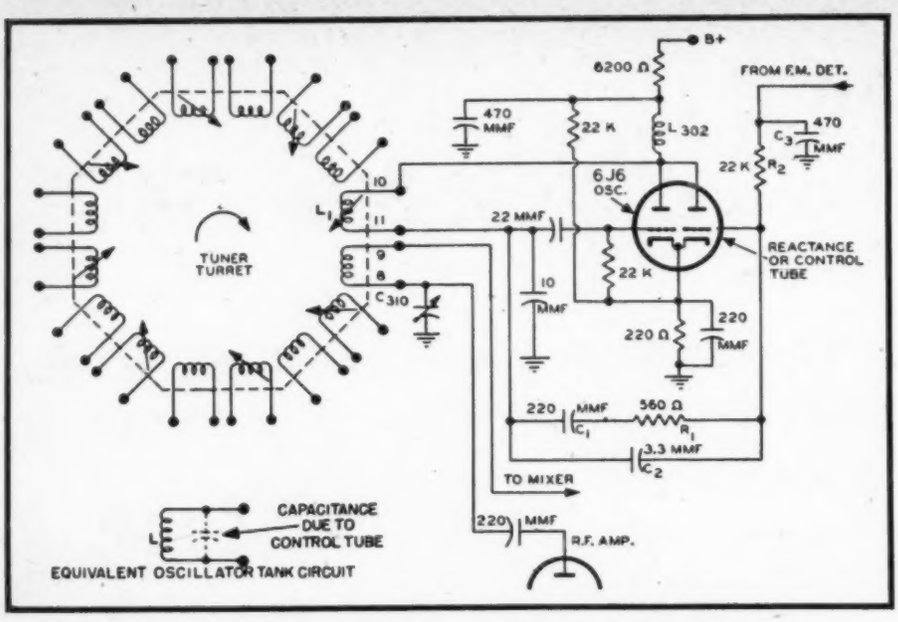


Fig. 5. Circuit diagram of the Philco oscillator and control tube stage.

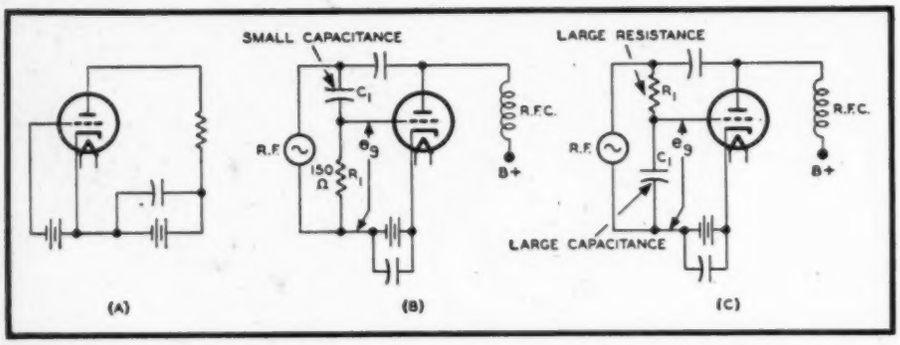


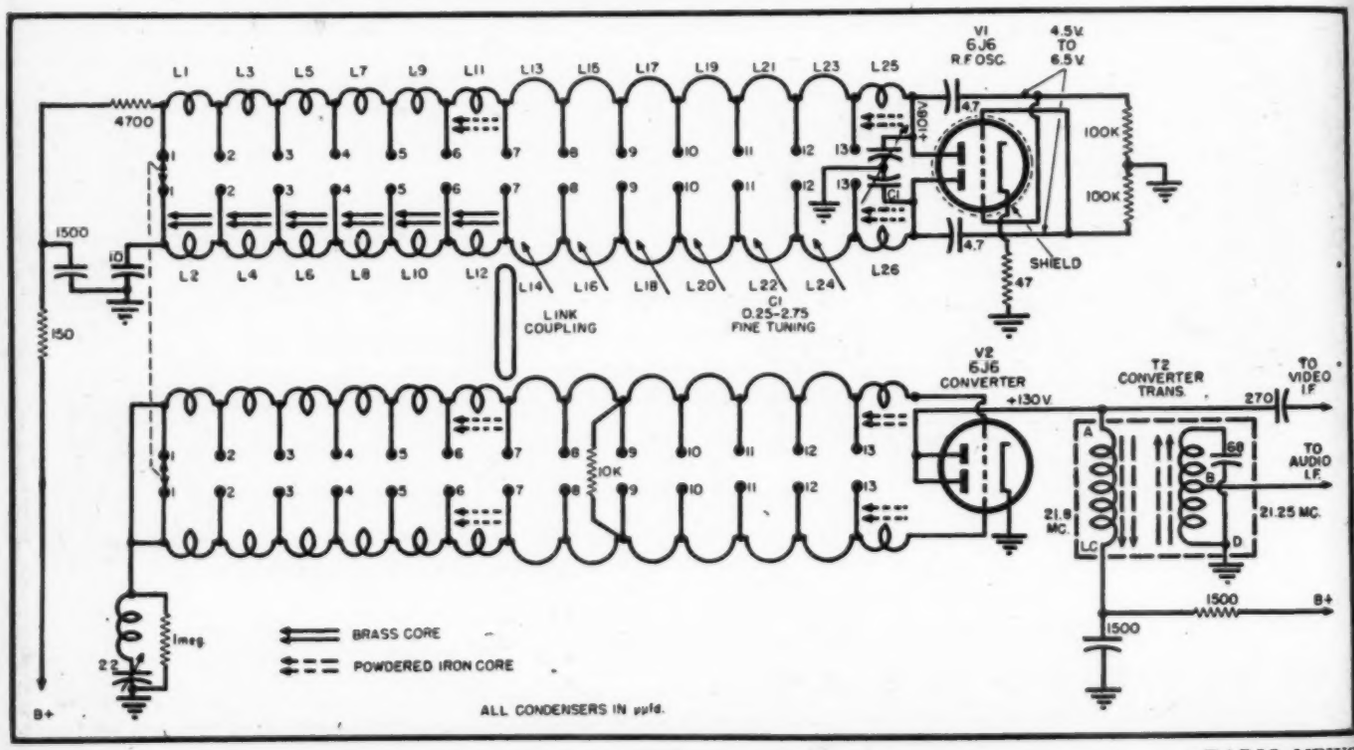
Fig. 6. Circuit diagrams show how a vacuum tube can be made to appear as a resistor (A), a condenser (B), or an inductor (C).

function as an inductance, we can employ the circuit shown in Fig. 6C. Now, we find that R_1 and C_1 have been interchanged and now the impedance of R_1 greatly exceeds the impedance of C_1, at the operating frequency of the r.f. voltage generator. The current now through R_1 and C_1 will be in phase with the applied r.f. voltage. However, across any capacitance, the voltage always lags 90 degrees behind the current and, therefore, the r.f. grid voltage, in Fig. 6C, will lag the current through R_1 and C_1 by 90 degrees. By the same token, it will lag the r.f. generator voltage by 90 degrees. Within the tube, the plate current, being in phase with the grid voltage, will also lag the r.f. voltage by 90 degrees. To the circuit, the tube will appear as an inductance in which the current lags 90 degrees behind the applied r.f. voltage. (If desired, a high resistance can be shunted across C_1 to provide a leakage path for any electrons accumulated at the grid. With a high value of resistance, the circuit operation remains unchanged.)

In each of the foregoing instances, the amount of inductance and capacitance that the tube injects into the circuit will depend upon the amount of plate current flowing through the tube. If we increase the d.c. bias for the tube in the positive direction, the plate current will increase and its reactive effect on the circuit will likewise increase. For a greater negative d.c. bias, the opposite action and effect will occur.

We are now in a position to examine the operation of the *Philco* oscillator circuit. Referring to Fig. 5, we note that the left-hand triode of the 6J6 is connected as an ultraudion oscillator. The plate of the second triode is connected directly to the oscillator plate lead and consequently feeds its plate current into the oscillator tuned circuit. The grid of the control triode receives an r.f. voltage from the oscillator tuned circuit through the capacitive-resistance network of C_1, R_1, and C_2. The same grid also re-

Fig. 7. Circuit diagram of the simulated transmission line tuner employed in RCA television receivers.



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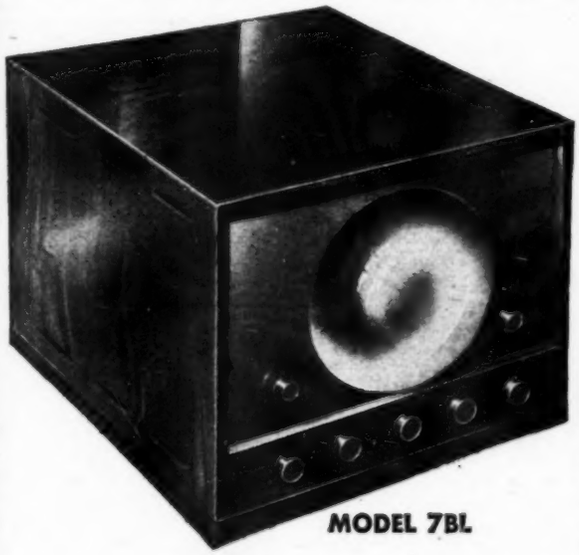

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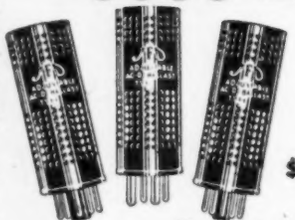

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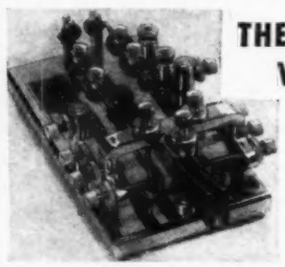

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2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	205-210	205.25	209.75	231
13	210-216	211.25	215.75	237

Table 2. Oscillator frequencies for a TV receiver in which the video carrier i.f. is 25.75 mc. and the audio i.f. 21.25 mc.

ceives a d.c. voltage from the FM ratio detector (not shown here).

The r.f. voltage that the grid of the control triode receives from the essentially capacitive network of C_1, C_2, and R_1 produces a leading current through R_2 and C_2. At the frequency of operation of this circuit, the opposition of C_2 is low in comparison to R_2, and the capacitive current from C_1, C_2, and R_1 flowing through R_2 and C_2 produces a voltage across R_2 which leads the oscillator tank voltage by 90 degrees. Since this voltage is also the grid driving voltage for the control tube, we find that the plate current of this tube will also lead the oscillator tank voltage by 90 degrees. Consequently, the plate current that the control triode feeds into L_1 will be a capacitive current, causing the tube to appear as a condenser shunted across L_1.

Now, whenever the oscillator drifts in frequency, a positive or negative resultant voltage will be developed at the ratio detector and this voltage will be fed back to the reactance tube. (How this positive or negative voltage is obtained will be discussed when we reach ratio detectors. For the moment let us just accept these results.) At the tube, a positive increase in d.c. biasing voltage will cause the oscillator tank frequency to decrease, whereas a negative rise will cause the oscillator frequency to increase. In this way, oscillator frequency drift is instantly counteracted and the set is kept on frequency.

The positive rise in d.c. grid voltage on the reactance tube will increase the capacitive current in the oscillator tuned circuit. A greater capacitive current is the same as adding a larger capacitance across L_1. This is so because $E = IX_c$ and if I increases, with E constant, then X_c must have decreased. Since $X_c = 1/2\pi fC$, a decrease in X_c can be brought about by an increase in C. However, the frequency of a tuned circuit is equal to $f = 1/2\pi\sqrt{LC}$ and an increase in C decreases the resonant frequency of the tuned circuit. Conversely, a more negative d.c. grid voltage will reduce the plate current of the reactance tube, thereby lowering C and raising the frequency of the circuit.

This is the first attempt to use automatic frequency control in a television circuit, although a.f.c. systems were standard equipment in AM sets several years back before the practice was abandoned as unnecessary.

All oscillators in television receiver practice are operated *above* the incoming signal frequency by an amount equal to the i.f. As an illustration, consider a receiver in which the video carrier i.f. is 25.75 mc. and the audio i.f. is 21.25 mc. The frequencies in

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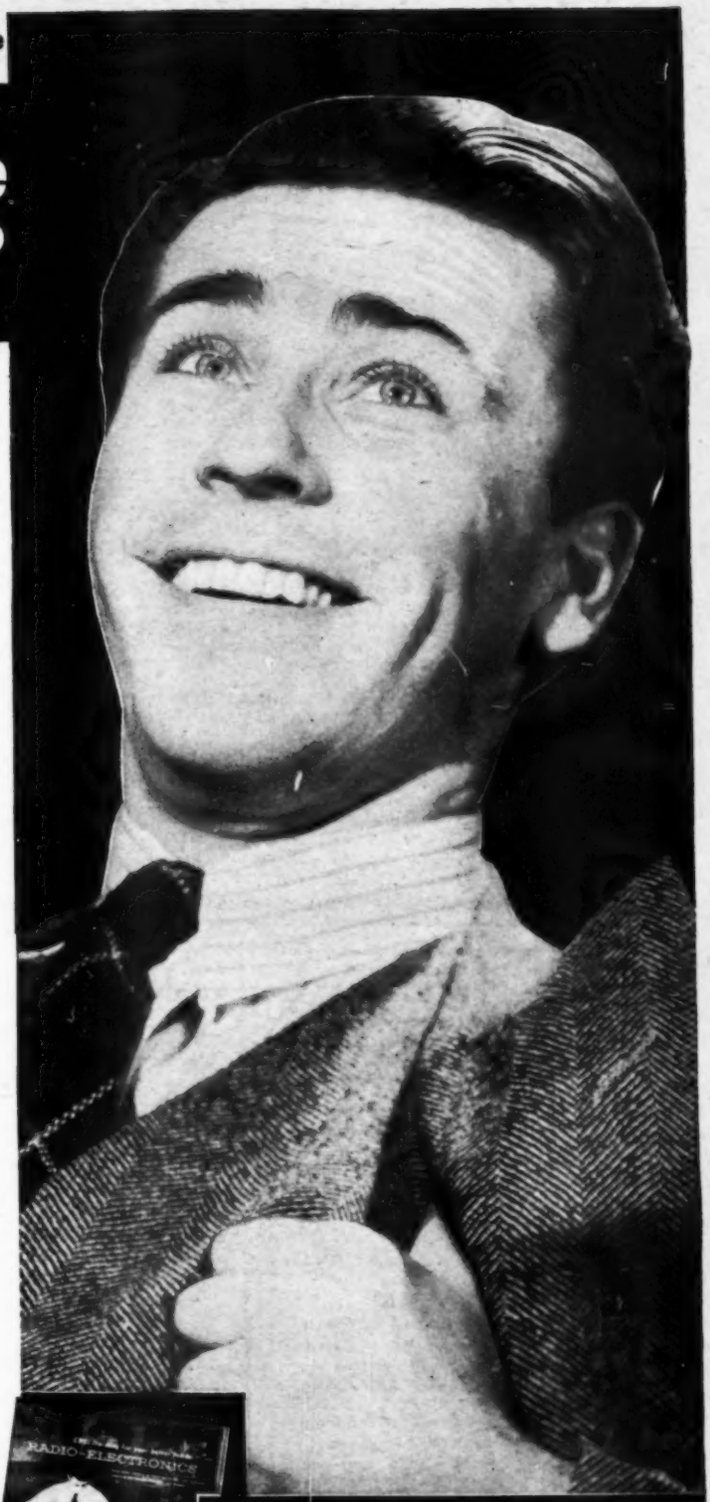

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005-01-02-1700 V. Buffer Cond.	29c ea.; 10 @ 24c
10 mfd can with nut and leads, 450 W.V.	79c ea. 10 @ 72c
16 mfd can with nut and leads, 450 W.V.	89c ea. 10 @ 79c
30 mfd can with nut and leads, 450 W.V.	99c ea. 10 @ 90c
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82 Speedwell Ave. MORRISTOWN, N. J.

this instance, for each of the thirteen channels are given in Table 2.

It is interesting to note that because the oscillator frequency is above the incoming signal, the relative positions of the video and audio carrier are reversed at the i.f. frequencies. That is, the video r.f. carrier is lower in frequency than the audio r.f. carrier whereas, after mixing, the audio i.f. carrier is below the video i.f. carrier.

Oscillator Servicing Whenever a defect in a television receiver has been traced to the r.f. section, it is best to begin the trouble-shooting procedure at the oscillator. The oscillator is the most critical stage in the front end of the set and most likely to be at fault. First, change the oscillator tube and then the mixer and r.f. amplifier tubes, in that order. Next, check the tuning circuit operation according to the procedure outlined in Part I of this series. If the defect still exists, then remove the receiver chassis from the cabinet and measure the voltage between the control grid and cathode of the oscillator. By doing this we can determine whether or not the stage is functioning. Measure this voltage using a high-resistance voltmeter, otherwise the readings obtained can be very misleading. The voltage at the oscillator control grid (with respect to the cathode) may have any value between −2 and −10 volts. Consult the service manual issued by the manufacturer for the proper values. Too low a value may be due to lowered operating potentials or low cathode emission. Low cathode emission reduces the oscillator voltage generated and this, in turn, lowers the conversion transconductance. Too low emission will eventually cause the oscillator tube to stop functioning. Measure the plate and screen voltages to determine whether these values are within the correct range. The oscillator grid voltage should be measured on all bands since it is very possible that the tube will function at some frequencies and not at others. Reasons for this may be a defect in the switching system or lowered emission. Oscillations are not generated as readily when we increase the frequency and subnormal emission can be the cause.

(To be continued)

WE HEAR -- THAT

THE recently released "Photofact" folder No. 38, published by Howard W. Sams & Co., Inc., carries the first section of a presentation covering television principles for radio service technicians.

Prepared by Albert C. W. Saunders and patterned after the course being offered resident students at the Saunders Radio and Electronics School at Newton Corner, Massachusetts, this new series will be included in consecutive sets of the folders. While the series is basic in its concept, it has been assumed that the serviceman has a good grounding in radio fundamentals. Each section of the series will be profusely illustrated with diagrams, sketches, and pictorials to assist the service technician grasp the principles involved.

The first presentation is a discussion of the picture tube while later issues of the folders will cover all of the different phases of television receivers and their servicing.

250,000 CARTONED RADIO TUBES 100 ASSORTED FOR $35.00

INDIVIDUALLY CARTONED — FULL REPLACEMENT — BRANDED HYVAC — YOU PICK THE TYPES FROM LIST BELOW

39c EACH — 100 FOR $35.00

117P7GT	12F5 GT	12SQ7 GT	6K6 GT	6SN7 GT	12BA6	1U4	12A6	6SF5	6BH6
32L7GT	6S8 GT	35L6 GT	6Q7 GT	6SQ7 GT	12BE6	1R5	12SF7	6BA6	6C5
12A8GT	6P5 GT	35Z5 GT	6V6 GT	25L6 GT	35W4	1S5	6F5	6BE6	117P7
12K7 GT	3V4	50L6 GT	6X5 GT	7D17 GT	35B5	3Q4	6J5	6AT6	32L7
25Z6 GT	6C5	6K7 GT	6SA7 GT	117L7 GT	50B5	3S4	6SJ7	6X4	12A8
6A7	12SA7 GT	6A8 GT	6SD7 GT	117Z3	1T4	1B4	12SJ7	6BJ6	
47	12SK7 GT	5Y3 GT	6SK7 GT	12AT6	1L4	12K8	6AJ5	6AK5	

Popular P.M. Speakers

AT LESS THAN HALF PRICE
EVERY SPEAKER GUARANTEED

4 in. P.M. 1 oz. Alnico V. mag. $0.99
5 in. P.M. 1 oz. Alnico V. mag. $0.99
5 in. P.M. 1.47 oz. Alnico V. mag. $1.19
5 in. P.M. 2.15 oz. Alnico V. mag. 1.49
6 in. P.M. 1.47 oz. Alnico V. mag. 1.49
6 in. P.M. 2.15 oz. Alnico V. mag. 1.98
6 in. P.M. 3.16 oz. Alnico V. mag. 2.95
8 in. P.M. 2.15 oz. Alnico V. mag. 2.95
8 in. P.M. 3.16 oz. Alnico V. Mag. 3.45
10 in. P.M. 20 oz. Alnico 3. mag. 4.45
12 in. P.M. 7 oz. Alnico V. mag. 4.95
12 in. P.M. 46 oz. Alnico 3. mag. 9.95

SAVE ON FIELD SPEAKERS

4 in. Dynamic, 450 ohm field $1.89
5 in. Dynamic, 450 ohm field 1.89
5 in. Dynamic, 1000 ohm field 1.89
8 in. 2 ohm field for heavy duty auto radio use. 2.95
8 in. Dynamic, 1000 ohm field 2.95
12 in. Dynamic, 1000 ohm field 4.95
13 in. RCA 450 Reg. 10.00 net 1¼" Voice Coil Scoop Price 4.95

SCOOP! ON NEW C.R. TUBES

Brand New Fully Guaranteed

3 BP1 ..... $1.95
3 BP1 ..... 1.95
5 CP1 ..... 1.95
5 BP4—Has white screen; ideal for television $2.95
5 FP7 ..... $1.95
7 FP7 ..... 2.95
9 LD7 ..... 2.95

2 Band coil, condenser kit. Consists of a matched 2 gang condenser, band switch and antenna and oscillator coil; for broadcast and foreign short wave. Scoop price $1.95.

Crystal hand mike, with 12 feet of cable. A handy item to have around. Scoop price; while they last, $3.95, each.

SPEAKERS WITH OUTPUT ATTACHED

5 in. P.M. 1.47 oz. Alnico V. mag. with 50L6 output. Special $1.49
5 in. P.M. 1.47 oz. Alnico V. mag. with Push-Pull output trans. ..... Scoop $1.69
5½ in. G.E. P.M. Square with 50L6 output trans. mounts in place of regular 6 in. speaker $1.95
6 in. P.M. 1.47 Alnico V. magnet with 7000 ohm primary output trans. ..... Special $2.25
Heavy Duty 8" 450 Ohm Speaker with 6V6 output .$2.95

POPULAR OVAL SPEAKERS

4x6 in. P.M. 1.47 oz. Alnico V. mag. $1.49
5x7 in. P.M. 2.15 oz. Alnico V. mag. 1.95
4x6 Dynamic, 450 ohm field 1.95

75% OF ALL THE TUBES YOU USE 49c EACH

Guaranteed Standard Brands Cartoned and Uncartoned

12AH7	6J5	6SQ7	12AT6	12SQ7
27	6K7	6SH7	12BA6	12SR7
26	9001	6SJ7	12BE6	50L6
78	9002	6SK7	12H6	12SK7
76	9003	6SL7	12J5 GT	25L6 GT
3S4	1625	6SN7	12SG7	35L6 GT
5U4G	954	6SG7	12SH7	35Z5 GT
5Y3G	955	6SR7	12SJ7	35W4
6AC7	6SA7	6V6 GT	12SA7	50B5
6C5	6SC7	6X5 GT	12SL7	
6H6	6SF7	6AB7	12SC7	

59c each 1½ Volt Octal—1N5 GT, 1H5 GT, 1A7 GT, 1A5 GT, 69c each Loctal Tubes—50A5, 35A5, 7A7, 7B7, 7E7, 7F7, 7N7, 7C5, 7Y4, 0Z4, 35Y4, 14A7, 14B6, 14Q7, 7E5, 79c each 1½ Volt Loctal Tubes— 1LN5, 1LC6, 1LH4, 1LD5.

BIG SALE OF GENERAL ELECTRIC AUTO AERIALS

Genuine General Electric Auto Aerials. Individually factory cartoned. All are made by Ward. This is a real scoop on autoaerials. Order a good supply now, and save from 50 to 75 cents, on these top quality aerials.

G.E. Model UZA-006, same as Ward SC-6, Side cowl 3 section 66", 36" shielded lead List $4.95. Sale Price **$2.49**

G.E. Model UZA-007, same as Ward SC-8, Side cowl 4 section 100", 36" shielded lead List $6.95 Sale Price **$3.49**

G.E. Model UZA-011, same as Ward TCF-3, Universal top-cowl mounting, 3 section 56". With 36" shielded lead. List $5.35. Sale Price **$2.65**

G.E. Model UZA-012, same as Ward DCF-3, 3 Section 56" fits all fenders, regardless of contour. With 36" shielded lead. List $6.25. Sale Price **$3.10**

BIG SPEAKERS—12" and 15"—SAVE UP TO 60%

12" 3 LB. MAGNET P.M. $9.95

Nationally known make—12" 3 lb. Alnico 3 magnet PM speaker, 1¼", 8 ohm voice coil. Factory cartoned, fully guaranteed. Will take 25 watts. Stock No. 12P8
NET $9.95

15" 1000 OHM FIELD $13.95

Nationally known make—15" 1000 ohm speaker, 1½" 16 ohm voice coil. Will take 25 watts. Factory cartoned, fully guaranteed. Stock No. 15U2
NET $13.95, Two for $26.50

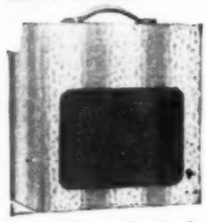
15" 7 LB. MAGNET—45 WATTS $21.95

Nationally known make—15" speaker with 7 lb. Alnico 3 magnet, 1½" Voice coil, 8 ohms. Factory cartoned, fully guaranteed. Super heavy-duty. This speaker will take up to 40 watts. A $40.00 value. Stock No. 15P7.
NET $21.95, Two for $41.95

15" 1 LB. ALNICO V P.M. $16.95

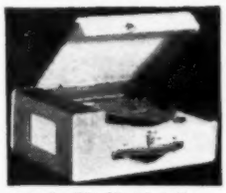
15" Nationally known make speaker, with 1¼" 8 ohm voice coil and 1 lb. of the famous new Alnico V magnet. Will take 20 watts. A $35.00 value. Stock No. 15-RY.
NET $17.95, Two for $35.00

$59.50 VALUE MUSICAL AMPLIFIER WHILE THEY LAST $19.95



8 watt musical amplifier, 4 tube AC type. Inputs for crystal or dynamic mike and phono or instrument pick-up. 2 gain controls and tone control. Has heavy duty built-in 8" speaker. Attractive leatherette covered case. Made by a large manufacture to sell at $59.95. Brand new, fully guaranteed. For 110 volt AC operation. Our scoop price, $19.95. Stock No. C-LX. Contact instrument pick-up, $6.95 extra. Deluxe instrument pick-up; with volume control, $8.95 extra. Crystal mike and desk stand $4.95. Shipping weight, 20 lbs.

PORTABLE RECORD PLAYER KITS



KIT MODEL J-41. Our leader record player kit. Fine tone, low needle scratch; includes two-tone leatherette covered portable case, rim-drive photo motor, high output crystal pick-up and 5" Alnico 5 PM speaker. 70L7 ready wired and tested amplifier. No wiring to do, just mount the parts in the case. Has the tone and volume controls. Kit Model J-41 Net **$14.95**

Kit model 61-X. Has a beautifully made leatherette covered portable case; similar in appearance to our model J-41. Has an even speed 78 RPM phono motor, light weight crystal pickup and a powerful, 4 tube transformer type; wired and tested, push-pull 7C5 phono amplifier. Has separate tone and volume controls. Full 6½", heavy duty PM speaker. All you do is mount the amplifier, motor and pick-up. This is the last word in portable record players. Kit 61-X. Net $22.95.

Above kit model 61-X, with single post automatic record changer $29.95.

DETROLA CHANGER $12.95 2 for $25.00

Detrola Changer, Base size 11⅛x12 inches, $12.95. Two for $25.00. Aero Changer, Base size 12x13 inches, $12.95. VM-800 Changer, Base size 13x14 inches, $14.95. Oak, twin-post changer, base size 14x14 inches, $17.95. General Instrument changer, base size 10½x12", $16.95. Seeburg, triple post, Worlds best, base size 14x14 inches, $37.95. Made to fit leatherette bases for above changers $1.95. Specify type of changer for base.

Compact Paper Tubular Electrolytics Condensers, Flexible Leads. Aerovox-CD or 1st Line

8x8x8 MFD 400 Volt, Long leads... $0.49; 10 for $4.50
40x20x10 MFD 150 Volt ..... .39; 10 for 3.50
50x30 MFD 150 Volt ..... .49; 10 for 4.50
50x30 MFD 150 V. 25 MFD 25V ..... .59; 10 for 5.25

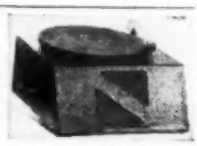
HOT ITEM DELUXE

8x8x8 MFD Inverted Aluminum Can Condenser 450 Volt, Standard Screw Mounting. Made by Aerovox. Special, $0.69; 10 for $6.25

14-WATT AMP. $29.95 THIS AMP. SHOULD SELL FOR $50.00

Here is a high fidelity amplifier scoop we may never be able to offer again. Licensed under Western Electric patents. Brand new factory cartoned, 14 watt average output; 25 watt peak output. Matches 4-8-16 or 500 ohm line. Complete with tubes 6SL7, 6SN7, 2—12SL7, 2—6V6gt and 5Y3. Designed for 110 volt AC, 60 cycle operation. Frequency response 50 to 12,000 CPS. Hum level down 69 DB. Gain for two mikes and one phono pick-up. Eastern amplifier. Model E14A ..... Net $29.95
Model E25A. Same as model E14A, except it has 2—6L6 output tubes, giving 30 watts output ..... Net $44.95

POWERFUL SINGLE RECORD PLAYER KIT Z-26.



Housed in an attractive leatherette covered cabinet. Latest 78 RPM rim drive motor and light weight pick-up. Ready wired and tested 70L7 type tube amplifier. Tone and volume control, 5" PM speaker (Alnico V). This kit easily slips together. Priced complete with tubes and hook-up instructions. Kit Z-26 ..... Net $9.95

G.E. VARIABLE RELUCTANCE PICK-UP. $4.65

Scoop—Pre-amplifier for General Electric Variable Reluctance pick-up. Easily connected to any AC or AC-DC amplifier. Wired and Tested with 6SC7 or (12SC7) tube. Diagram for connections is furnished. Specify whether you want pre-amplifier for AC or AC-DC use. Net price. Pre-amp. with Tube and G.E. Pick-up—$6.95.

G.E. Variable reluctance pick-up cartridge with permanent needle. Net $4.69.

RECREATION ROOM CONSOLE $19.95

Recreation room console size leatherette covered cabinet, made of heavy plywood. Covered with bright blue leatherette. Size 16"x24"x36" high. Has 7" depth under hinged lid. Room for any make of automatic changer. Cabinet is ideal for a recreation room, record player. Cut for speaker 12" speaker. Stock No. R1-B12. Weight 50 lbs. Net $19.95.

PORTABLE P.A. $39.95

18 watt complete portable public address system. Has inputs for a crystal or dynamic mike and phono pick-up. Has push-pull 7C5 tubes in output. Attractive leatherette covered split type case. Priced complete with two 10" PM speakers. This is a complete public address system wired ready to play. Stock No. RC-18. Net $39.95. Priced complete with crystal mike and desk stand.

We guarantee every condenser to be of fresh stock. Made by nationally known manufacturers. No junk.

F.P. ELECTROLYTICS

40x20 MFD 150V... $.39
40x20 150V 10-25V .. .49
40x20 150V, 200-6V .. .59
20 MFD 350 V, 20x20 25V ..... $.19
20x20 300V, 25-25V .. .39

TUBULAR ELECTROLYTICS

Exactly as you buy every day. Best National Brand. If these are not brands you prefer, your money back.

8 Mfd 450v Aluminum Tubular $0.39
20 Mfd 150v Aluminum Tubular ..... .39

COAXIAL 12" PM

BRAND NEW IN FACTORY CARTON SALE PRICE

$12.95 TWO FOR $25.00

Designed by one of America's finest speaker builders, for FM high fidelity radios; selling in the $500.00 bracket. Has 12" Alnico V PM with 4" built-in 'tweeter'. The hi-pass filter is built-in. Just hook on to any 8 ohm output transformer. Will take approximately 18 watts. This speaker should sell for $35.00. Why buy a regular speaker, when we are offering a co-axial speaker at only $12.95. Stock No. 4-12X. Weight 8 lbs. Only a few hundred available.

McGEE RADIO COMPANY

WRITE FOR CATALOG *Prices F.O.B. K.C.*

SEND 25% DEPOSIT—BALANCE C. O. D.
1225 McGEE ST., KANSAS CITY, MISSOURI

PERSONAL PORTABLE RADIO KIT
MAKES A $32.50 RADIO

$14.95
Complete with Batteries

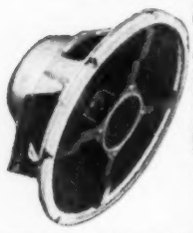
Size: 6½"x3¼"x4⅛" **Weighs Only 3½ Lbs.**

- **Two-Tone Ivory, Red Plastic Cab.** • **Loop Aerial, Built-in Lid**
- **4-Tube Superhet** • **AVC.** • **Looks like and is a Commercial Radio Kit**
- **Two-Gang Cond., Lucite Dial** • **Simple Assembly and Wiring Instructions**

This kit is ready for immediate delivery. The same nationally known factory that manufactures tens of thousands of this radio, is line-producing this radio kit for us. Every part, from the cabinet down to the last resistor, is matched. The chassis is ready punched; all you do, is mount the parts and wire. This radio kit will assemble into a beautiful personal radio for you, just the same as it does for the factory. We furnish you a diagram, photograph of the competed chassis and full assembly instructions so that those with a minimum knowledge of radio may wire this kit. The beautiful case is made of metal with plastic hinged lid and snap on back. The lucite face of the receiver has an inlaid gold design. The circuit is the conventional two gang superhet type, with A.V.C. Receives the broadcast band, 540 to 1650 KC. Uses miniature tubes: 1R5 converter, 185 detector A.V.C., 1T4 amplifier and 3S4 power amplifier. Alnico V PM speaker. The loop antenna is built in the lid. Radio comes on automatically when lid opens. Operates on self-contained batteries. Priced complete with tubes and 67½ volt "B" battery and flash cell (Not AC-DC). Nothing else to buy. **Model X-45, Price $14.95.** Include Postage for 6 lbs.

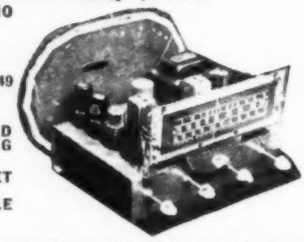
SCOOP MODEL X-45 PERSONAL PORTABLE KIT WIRED AND TESTED WITH BATTERIES. NET $17.95

8-TUBE RADIO KIT WITH COAXIAL SPEAKER, $37.95



A COMBINED BROADCAST SUPERHET RADIO CHASSIS AND 15 WATT P. A. SYSTEM
HEAVY DUTY 12" P.M. SPEAKER
CROW 8" SLIDE RULE DIAL. 2 GANG COND.
REC. BROAD. 550 TO 1700 KC AND 19 TO 49 METERS
PUSH PULL 6V6—TONE CONTROLS
INPUTS FOR CRYSTAL OR DYN. MIKES AND PHONO-PICKUP. WE FURNISH EVERYTHING TO BUILD THIS DELUXE CHASSIS

- **WHY NOT ORDER THE ARMCHAIR CABINET WITH THIS KIT**
- **HAS INPUT GAIN FOR THE G.E. VARIABLE RELUCTANCE PICKUP**
- **CHASSIS SIZE 9½x11x8" HIGH**

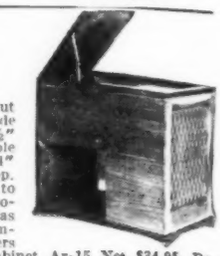


Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7. 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs.

PRK-24 Radio-Amp. Kit with 12" P.M. speaker With tubes .....Net **$29.95**

CPR-15. Exactly the same kit as the PRK-24 kit; except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) This is our finest kit .....Net **$37.95**

ARMCHAIR CABINET ONLY $29.95



Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep, and 27" wide. Ample room for radio receiver 14" long, 9" high and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet Ar-15 Net $34.95. Detrola automatic changer $12.95 extra.

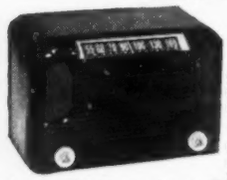
NAVY GLIDE PATH SCOOP $3.95

Navy model ZA Glide path receiver. Has 3—6C6 tubes; several controls, transformer and handy case; size 6x7x12 inches. Ideal for salvage, near new condition $2.95; 2 for.....$5.50

FACTORY RADIO KITS MADE FROM DETROLA, etc. MATCHED COMPONENTS

EVERY PART FITS—CHASSIS ARE PUNCHED—DIALS PROPERLY DESIGNED—COMPLETE DIAGRAMS

1949 MODEL AC-DC KIT $12.95

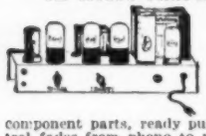


This is our latest and finest AC-DC radio kit. Receives Broadcast, 540 to 1650 KC. Has full length illuminated slide rule dial. Choice of Ivory or Walnut plastic cabinet. Full high efficiency 2 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every parts fits. Everything furnished, including tubes, 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6. This kit will go together just like it would on the production line. Diagram, photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49. Net $12.95.

20-WATT UTILITY AMP. KIT, $17.95

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts and easy-to-follow diagram furnished, including tubes: 2—6SN7, 6J5, 2—6L6GA, 5Z3. Kit Model 20-LX.....Net **$17.95**

12 WATT AMPLIFIER KIT, $10.95



Push Pull 6V6's Gain for Mike

KIT MODEL AC-12. 12 watt amplifier kit. Ideal for high quality record player as well as public address or recording amplifier. Matched component parts, ready punched chassis pan. One control fades from phono to microphone. Gain enough for crystal or dynamic microphone. 100 mil power transformer, for 110 volt AC 60 cycle operation. Priced complete with tubes: 2—6V6, 6SN7, 6SH7 and rectifier. Diagrams and photos furnished. Kit AC-12. Net **$10.95.** 12" Alnico 5 PM speaker $6.95 extra; crystal microphone and desk stand $4.95 extra.

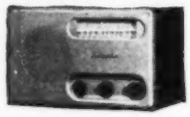
The above AC-12 amplifier wired and tested ready to operate net **$14.95** Specify stock No. AC-1125, 12 inch Alnico V PM speaker $5.95 extra. Crystal mike and desk stand $4.95.

PORTABLE RADIO DISC-RECORDER KIT, $54.95

$90.00 value for only $54.95. We furnish every part to build a powerful radio and dual speed recorder. The attractive leatherette case houses the sensitive superhet broadcast radio and General Industries R90L 33⅓ and 78 RPM dual speed recorder; play back mechanism. The 6 tube receiver and amplifier is all on one chassis; 12SA7, 12SQ7, 12SK7, 12SL7, mike gain; two 35L6 push-pull output; plus disc rectifier. Has plenty of gain for crystal or dynamic mike. Has 6" heavy duty PM speaker and tone control. Kit G-31, everything complete, with tubes and diagram. $54.95. Crystal mike and desk stand $4.95 extra. This is without a doubt one of the best values in kits we have ever offered. Wt. 40 lbs.

AMERICAN AND FOREIGN KIT $14.95

550 to 1600 KC and 6 to 18 MC



This radio kit is housed in an attractive grey opalescent finished metal cabinet. Incorporates a standard 2 gang superhet circuit. Receives Broadcast (550 to 1600 KC) and foreign short wave (6 to 18 Megacycles). This kit is complete, nothing else to buy; just as all our kits. Ready-punched chassis. It will go together just as it would down a production line. Has full 5" PM speaker. Complete with tubes: 12SA7, 12SK7, 12SQ7, 35Z5, 50L6. Diagram, photos and instructions are furnished. Shipping weight 10 lbs. Kit model DT-5. Net **$14.95**

$50.00 VALUE DAYCO TUBETESTER $32.50

Latest up to date Dayco portable tester, with illuminated roll chart; with wide angle magnifying lens. Never becomes obsolete. Sockets are provided for all bases: 4, 5, 6, 7, prong, octal, loctal, acorn, bantam, miniature, etc. Has both quality and short tests. Best tube checker value today. Portable Model 2194 Net **$32.50.** Model 2193 is the same as the 2194 except it is a counter model in black wrinkle finish, with sloping front panel. Counter Model 2193 Net **$29.50.** These tube checkers should sell for at least $10.00 more.

AMERICAN XTAL CARTRIDGE $1.49

American crystal replacement phono cartridge. Standard mounting; most one size used. Long shielded leads, Scoop price $1.49

SCOOP PRICES ON VIBRATORS

Standard 6 volt vibrators for every day replacement use—All guaranteed, Genuine Mallory sync. vibrator unit. Ideal to put in old can for Buick, Delco, etc. Scoop price $0.99
4 prong war surplus; new in bent cans..... 0.79
4 prong UTAH NP-42 for Philco..... 1.29
4 prong SMALL for Ford..... 1.49
4 prong OFF-Set for Delco..... 1.49
5 prong standard sync. 1.49
6 prong standard sync. 1.49
6 prong reversible sync. 1.99
7 prong reversible sync. 1.99
5 prong OFF-Set sync. 1.99
Sync. unit: Vibrator unit only; with cond..... 1.99
7 prong 2 volt; G. E. sync..... 1.99

DETROLA CHASSIS $16.95

Detrola Factory wired and tested chassis. Size 7¼ deep, 4½" tall and 13" long. Receives 550 to 1600 K.C. RF stage and 3 gang tuning condenser. Loop ant. Etched glass slide rule dial. With tubes 2 6SK7, 6SA7, 6SQ7, 6K6, 5Y3, 8 in. Heavy duty speaker. This chassis is ideal for the above arm chair cabinet. Input for phono pick up. Tone control and phono switch. Brand new. Should sell for $40.00 Stock No. DTR-6 Net $16.95. Weight 20 Lbs.

WALNUT CABINET KIT $11.95

Attractive 13" walnut cabinet AC-DC radio kit, with illuminated slide rule dial. Has made-to-fit metal front grille. Incorporates a standard 2 gang superhet circuit. Loop antenna, ready-punched chassis. This is another one of our line production radio kits. Every part is furnished. Includes tubes: 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6. Diagram, photos and instructions are included. Has full 5" Alnico 5 PM speaker. Receives broadcast 550 to 1650 KC. Shipping weight 9 lbs. Model ES-6. Net **$11.95.**

SCOOP. The above model ES-6 WIRED AND TESTED in either Blond or Walnut cabinet. Net $14.95.

WIRE RECORDER $69.95

Portable Wire Recorder Model GN-11

Has ready wired and tested 5 tube AC type amplifier with push-pull 6V6 tubes. Built-in eraser circuit. Input for crystal mike or phono pick-up. Diagrams show how you can record from any radio receiver. 3 position switch enables you to quickly change from record to playback or conventional P. A. system. This amp delivers 12 watts of good clean audio. Here is what you get: Webster 79 recording mechanism, with 15 minute spool of wire, attractive leatherette covered case, 6" heavy duty PM speaker and wired and tested 12 watt AC wire recording amplifier. All you do is mount the amp, recording mechanism and speaker. Simple instructions furnished. Portable Recorder Model GN-11 Net **$69.95.** Crystal mike $4.95 extra.

DELUXE WIRE RECORDER $79.95

This wire recorder incorporates all necessary circuits for recording and playbacks. Has built-in eraser circuit. The amplifier is of the AC transformer type, with push-pull 6V6 output tubes. Has tone control and fader control. Input stage for wire recording from either crystal mike, radio receiver or phono pick-up. Amplifier is wired, tested and ready to operate. This unit is classified as a kit, only because you have to mount the Webster wire recording mechanism, amplifier and speaker. Everything is furnished, including a 15 minute spool of recording wire. Kit includes wired and tested 12 watt amplifier, expressly made for wire recording and public address use. Leatherette split type case and 10" PM speaker, furnished with regular $52.92 Webster wire recording mechanism. Kit model GN-12. Net **$79.95.** Crystal mike and desk stand $4.95 extra.

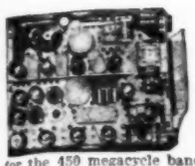
NEW BC-1206 $5.95

Designed to receive A-N beam signals, 24-28 vdc. Tube complement: 14H7, 14A7, RF, 14H7, 14J7, 14A7, 14H7, IF amplifier: 14R7, detector and 1st audio; 28D7, output. 195 to 420 KC 4" high x 4" wide x 6⅝" long. Weight 4 lbs.

McGEE RADIO COMPANY

WRITE FOR CATALOG
PRICES F.O.B. K. C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI



BRAND NEW BC-645

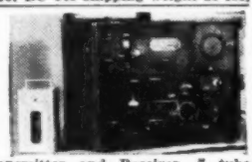
9.95 TWO FOR $19.00

A small complete Transmitter and superhet receiver, for the 450 megacycle band. Diagrams for building AC power supply and conversion furnished. Ideal for MCW, CW or phone. The tubes (4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and WE-316A) are worth more than our sale price. BC-645 I.F.F. unit **$9.95** each, Two for **$19.00** Extra WE-316A tube **99c**. 12 volt DC dynamotor (furnished all power) **$2.95**. BC-645 shipping weight 25 lbs.

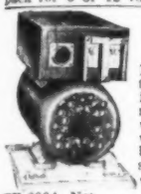
BC-654 TRANS-REC

$12.95

TWO FOR $25.00



BC-654 Portable Transmitter and Receiver. 7 tube superhet receiver and 6 tube transmitter. Covers from 3800 to 5800 KC. Furnished with all 13 tubes (low drain battery type). Units have been used but are in good condition. BC-654 weight 50 lbs. One of our best surplus values. **$12.95** each, two for **$25.00**. Vibrator pack for 6 or 12 volt operation **$4.95**, extra.



PE 206A INVERTER—BRAND NEW $4.95

P.E.-206A Inverter. Brand new factory cartoned. For 25 to 28.5 volts input. Output of 80 volts (plus or minus 3 volts) at 800 cycles, at 500 volt amperes. This is a perfect inverter. Has carbon pile regulator, built-in voltage control. A 20 stack selenium rectifier. Shipping weight 45 lbs.

PE-206A Net $4.95

PE 101C Dynamotor Brand New $2.95

Dynamotor PE-101C. Input voltage 13 or 26 volts DC, at 12.6 or 6.3 amps. Output voltage 400 volts DC at 135 Mils and 800 volts at 20 Mils, 9 volts AC at 1.2 amps. Brand new factory cartoned. Shipping weight 13 lbs.
PE-101C Net $2.95

Pulse Forming Networks

Used in small radar modulators, available in three sizes, 67 ohms impedance, 7.5 Kilowatt rating.
H-603, one micro second, 200 pulses per second.....$1.95
H-601, three micro seconds, 200 pulses per second $2.95
H-602, 16 micro seconds, 60 pulses per second.... 3.95
All three of above, for only..... 5.95

Crystal Calibrator $2.95

Crystal Calibrator, gives 50 KC beat note through an Xtal synced, multivibrator. Furnished complete, less 200 KC Crystal. With tubes 12SA7 and 2—12SL7. A handy item to have. Scoop price...$2.95

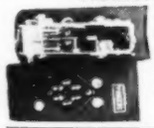
PORTA-POWER

Electro Porta Power. Converts any 4, 5, or 6 tube 1½ volt, 90 volt portable or farm radio to 110 volt AC operation. Multiple socket arrangement makes easy, quick connection possible. Every shop should have one of these. Regular $9.95 value. Scoop price $5.95

SELSYN INDICATORS $2.95

Selsyn indicators, 5" diameter. Will operate on from 15 to 24 volts 60 cycle AC. Model I-82A can be used as either selsyn transmitter or selsyn receiver. Scoop Price, $2.95. 2 for $5.49

VIBRATOR SCOOP $1.99



Heavy Duty Vibrator—Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price.....$1.99
135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor...$5.95
(Use with above vibrator)

SMALL PHONO MOTOR. This 110 volt AC, 60 cycle phono motor is used on 80% of all automatic changers. Order one just to have around for replacement. Scoop price, $1.49: Two for.....$2.79

$4.95 EACH 3 FOR **$14.00**

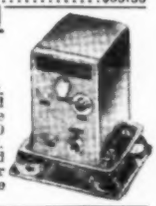
Super value. Folded Di-pole antenna, for FM and Television. Complete with 60 feet of twin 300 ohm line and 4 low-loss stand-off insulators. This folded di-pole covers frequencies 42 through 108 megacycles. Trombone action makes exact tuning to any one weak station. Furnished with adjustable mounting bracket. Has 5 foot mast. Made for Stromberg-Carlson. Stock No. Mt-300—Net **$4.95**; lots of three, **$4.50** each. Weight 4 lbs. Individually packed.

Brand New

ELECTRONIC MEGAPHONE SCOOP PRICE $39.95

Only 50 of these to sell. Amplifier straps on shoulder, then just hold megaphone and speak into mike, mounted on rear of projector. These units are brand new. Amplifier is dry battery operated. Just pull trigger switch, amplifier comes on immediately. Net $39.95

MARKER BEACON REC. $2.95

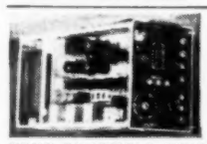


BC 1023 A Marker beacon receiver. Designed for reception of modulated signals of the 75 MC band. Variable tuning permits coverage of 62 to 80 MC. Brand new factory cartoned. With tubes 6SQ7, 6U6, 6SC7 and 12SH7. Operates directly from 12 or 14 volts DC. Priced for quick sale only $2.95.

SCOOP! 110 M.C. REC. $6.95

BC-733 D Localizer Receiver

Freq. 108-110 Mc; Tube complement; 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—AH7GT, 2—12SG7, 3—717A. Now only.....$6.95
BRAND NEW.
A RED HOT VALUE.



ARC-4 $14.95

IDEAL FOR 2 METERS

Priced Complete With 20 Tubes—and 12-28 Volt Dynamotor

FOUR CHANNELS CRYSTAL CONTROLLED. ARC-4 for VHF frequencies 140 to 144 megacycles. There are 7 tubes in the transmitter: 832, two 1614, two 6V6 and two 6L6. The receiver section has 13 tubes: two 6AC7, four 6N7, three 12SJ7, two 12SQ7 and two 12A6. The unit is actually two receivers and one transmitter in one piece. One receiver is for stand-by use. Has built on dynamotor for 12 or 24 volt DC operation. Priced complete with tubes and four crystals and dynamotor. Hams convert this for two meter operation. It's a scoop at this price. Used.

RDF RECEIVER $19.95

MM-26-C Compass Receiver. Brand new factory cartoned. This unit covers from 150 to 1500 KC inclusive; in three bands. Complete with eleven tubes of the 6 volt type; 6SA7, 6SK7, 6F6, etc. Has 28 volt built-in dynamotor. There is no dial built on unit and no remote cables are provided. MM-26-C receiver $19.95 Remote control $3.95 extra.
Manually operated loop.....$6.95 extra

SCR-518 ALTIMETER $29.50

Brand New

Famous SCR 518 A Altimeter. Brand new factory cartoned. Worth over $900.00. Made by RCA. Complete as pictured. Has 29 tubes. Works in the 500 MC region. This is the complete unit. Transmitter, receiver, power supply and 3" scope indicator. Reads altitude up to 30,000 ft. Operates on 28 volts, D.C. Complete with tubes, 6SK7, 2 8012, 2 6SJ7, 6C8, 6SN7, 6F8, 23D4, 6V6, 10 6AC7, 3 2X2, 954, 955, 956, 6J5 and 3 in. CR tube 1808P. A RED hot scoop at only $29.95 complete.

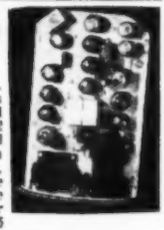
ARMY $6.95

Field Telephones

EE-8 Army field telephone. These units are used, but in good condition. Priced complete with telephone hand set, hand powered magneto and canvas carrying bag; as pictured. Net $6.95, each.

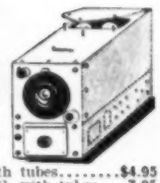
15 TUBE SCOOP $9.95

BRAND NEW



AM 61A Indicator Amplifier. Brand new factory cartoned. Has 28 volt DC Blower motor and fan. 2 2mfd 1000 volt cond. 2 2X .5 mfd. 1000 volt cond. and many other parts. Complete with 15 tubes, 7 6SN7, 3 VR 105, 5Y3, 3 6SL7, 8016. As a salvage item this is a RED Hot Buy. The tubes are worth more than our price. Weight 30 lbs. Net $9.95

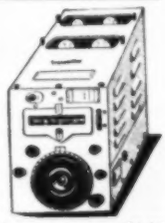
COMMAND REC. with Diagrams



Order your Aircraft command receivers from McGee. We furnish you a schematic of the BC-454 (all are the same except for frequency). Also, a diagram showing how to convert receivers for 110 volt operation.

Used BC-453, 200 to 500 KC, with tubes.....$4.95
Brand new BC-453, 200 to 500 KC, with tubes... 7.95
Used BC-454, 3 to 6 MC, with tubes..... 3.95
Brand new BC-454, 3 to 6 MC, with tubes..... 5.95
Used BC-455, 6 to 9 MC, with tubes..... 3.95
Triple remote control head for 3 receivers..... 1.95
Triple mounting rack for 3 receivers..... .99
28 volt receiver dynamotor ..... .99

NEW COMMAND XMITTERS $5.95



With each command transmitter, we furnish a schematic of the BC-458 (All command Transmitters are essentially the same; except for frequency.)

Used BC-457, 4 to 5.3 MC, with tubes.....$4.95
Brand new BC-457, 4 to 5.3 MC, with tubes..... 6.95
Used BC-458, 5 to 7 MC, with tubes..... 4.95
Brand new BC-458, 5 to 7 MC, with tubes..... 6.95
Twin rack, for 2 transmitters..... .99
Antenna Current Meter, used $1.95. New..... 2.95
New Modulator, BC-456..... 2.95
Used Modulator dynamotor, 28v..... 1.95
Extra VT-136 (Trns. output Tubes). Each..... .49

VEEDER ROOT METER

Counts number of feet of trailing wire antennae; number turns when winding on coil; applicable for many uses; beautiful bakelite case, jewelled dialite, pilot light enclosed, 3 position switch, counts up to 1000.
Each 95c

3" SELSYN INDICATOR

Works on 16 to 25v. 60 cycle

$2.45 EACH **Two for $4.45**

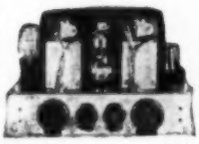
TURBO AMPLIFIER $1.95

Aircraft Turbo Amplifier, complete with 4 tubes, 7F7, 7Y4 and 2—7C5. Terrific salvage scoop. Ideal to wreck for parts.
Priced new with tubes.....$1.95
Monthly Special. Turbo amplifier less tubes. Weight 4 lbs. Only..... .69

AM-26 $1.49

AM 26 interphone amplifier. This unit is nice for parts salvage and the aluminum case is usable for receiver building etc. Size 9½x4½x5". Has two transformers, four tube sockets, three filter condensers, three position panel switch, toggle switch, and many small parts. All are in perfect condition.
$1.49; 2 for $2.49

MODULATOR SALVAGE $2.95



Another red hot value in salvage. All kinds of good usable parts in this unit. Con. Res. Relays, Modulation trans. and tubes VR150, 1625 and 1625. Brand new and in factory carton. Originally designed to modulate the BC-457 W.E. Transmitter. You can find many uses for this BC-456 Modulator scoop. 28V Dynamotor.....$1.95

ANT CURRENT METERS $1.95

Antenna Current Meter as used with the popular command transmitters. Has 0 to 10 2 inch. Thurmo coupled meter. Built in vacuum condenser. A scoop value.

Used $1.95: two for.....$3.69
New $2.95: two for.....$5.50

PACKARD BELL PRE-AMP $1.99

Housed in a handy aluminum case 5x4x5, priced complete with tubes 6SL7, 28D7, has many usable parts. Relay and control PL68 plug and patch cord.

McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY

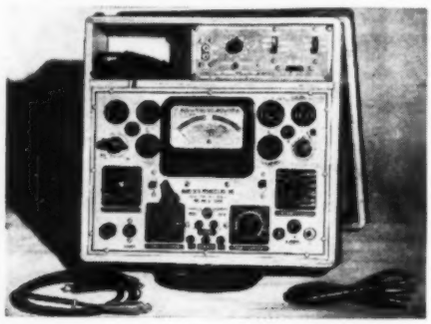
SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

What's New in Radio

"PORTABLE SERVICE SHOP"

Radio City Products Company, Inc. has developed and is marketing a new test instrument, a "portable service shop," which is a combination of six essential servicing units.

Housed in a single carrying case are a tube tester, multitester, FM signal



generator, AM signal generator, audio oscillator, and condenser tester. Designated the Model 8073 Servishop, the unit is available in a natural oak carrying case which measures 5"x13"x 9½" and weighs 15½ pounds. The unit comes complete with all tubes, test leads, and operating instructions. It will operate on 50 or 60 cycle lines from 105 to 135 volts.

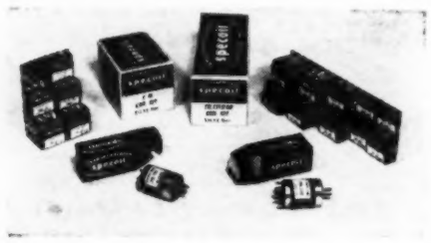
The tube tester will check all the new miniature tubes and carries 800 listings in the tube charts. The meter is fused as an added protection. The condenser tester reads "good" or "bad" for leakage of electrolytics, paper, or mica condensers. Both FM and AM signal generators are set for four needed calibration frequencies. The audio oscillator has a 400 cycle output.

For further details readers are requested to write to the company direct. Address inquiries to *Radio City Products Company, Inc.*, 152 West 25th Street, New York 1, New York.

TV AND FM COIL KITS

Of interest to the experimenter and radio amateur are the complete coil kits now being placed on the market by *Special Products Company* of Silver Spring, Maryland.

The new "Specoils" are designed for



the builder who wishes to construct his own FM tuner or television receiver. Two kits are available. One includes a set of six coils for building a high fidelity FM tuner. A circuit diagram showing a typical FM tuner is enclosed with each coil. The second kit is a set of eleven television coils complete with circuit diagrams for building the TV sound and video sections.

The coils are slug-tuned with the tuning adjustment at the top, thus making it unnecessary to get on the under side of the chassis.

The kits are now being merchandised by parts distributors throughout the country. Additional data may be secured from *Special Products Company*, Silver Spring, Maryland.

NEW VARIAC

General Radio Company of Cambridge, Massachusetts has recently introduced the Type V-20 Variac for the manual control of a.c. voltage.

Latest item in the company's line of Variacs, the new unit is capable of handling 20 amperes in the 115 volt model. The 115 volt model, designated the Type V-20M is rated at 3.45 kva., while the 230 volt model, the Type V-20HM, is rated at 2.3 kva.

Output voltage is continuously ad-

justable from zero to 17 per-cent above input line voltage. Both models are supplied with case and terminal box cover. The terminal box is designed for use with BX or conduit. The overall dimensions are 7⅞" x 9⅝" x 5½" and the unit weighs 22¾ pounds.

For additional details on this unit write *General Radio Company*, 275 Massachusetts Avenue, Cambridge 39, Massachusetts.

NOISE FILTER

A new noise filter, the Type X6, is now being distributed by *P.R. Mallory & Co., Inc.* of Indianapolis.

Designed to eliminate radio interference caused by various electrical appliances, this filter may be installed between the plug of the offending appliance and the wall outlet.

A colorful display card for merchandising these filters has been designed for radio servicemen and appliance dealers. Details are available from the company's distributors or from the *Wholesale Division, P. R. Mallory & Co., Inc.*, Indianapolis, Indiana.

NEW WIRE RECORDER

A new wire recorder, especially designed for easy connection to existing amplifier circuits, has been announced by *Webster-Chicago Corporation.*

The Model 78 utilizes push-button controls for greater flexibility of operation in any of four "record" and "listen" positions. The unit consists of a wire transporting mechanism, a preamplifier, interstage amplifier, oscillator, and built-in power supply. An accurately calibrated recording level meter assures correct recording volume. The recorder is housed in a metal case measuring 11⅜"x11"x5⅝".

Webster-Chicago Corporation, 5610 W. Bloomingdale Avenue, Chicago 39, Illinois will supply additional details on request.

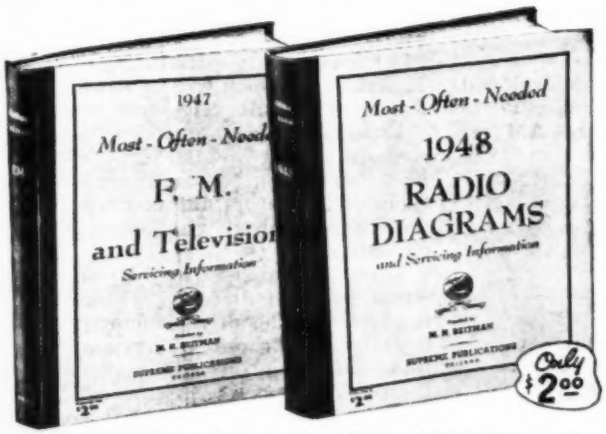
MONITOR AND SENDING KEY

Of particular interest to hams is the new "Mon-Key" electronic monitor and sending key being manufactured by *Electric Eye Equipment Company.*

This electro-timed automatic key makes dashes proportional to dots and keeps spaces uniform for the sending speed. Sending speed can be regulated by a dial setting from approximately 8 w.p.m. to 40 w.p.m. The unit is also a monitor, producing a clear tone that can be regulated as to volume or tone or the monitor tone can be cut out entirely by turning a knob.

The key controls a multivibrator of extremely simple design. No open condenser is switched in and out of the circuit. Resistors of 5 per-cent tolerance are used in the timing network. These, in conjunction with two equal condensers, are the only components in the "critical" category. The multivibrator drives the grid of the keying relay tube. This tube actuates a relay having two 2-amp. contacts, one set of contacts terminating on binding posts under the key. The other contacts key the grid of an electronic audio oscillator. This oscillator drives a 2" PM

New SUPREME 1948 and F.M. Manuals



F.M. and Television

Use this new giant manual of factory instructions for trouble-shooting, repairing, and alignment of any 1947-1948 **F.M.** and **Television** set. Covers every popular make, including F.M. tuners. AM-FM combinations, and all types of television receivers. Detailed circuit diagrams, theory of operation, test hints, alignment data, including both **meter** and oscilloscope methods. This is the material you need to fix any modern F.M. or Television set. Don't turn this profitable work away for lack of knowledge and information. Use this newest **Supreme** manual to save time and money on your very next F.M. job. Data presented on 192 large-size pages, 8½ x 11 in. Sturdy, manual-style binding. Special price, postpaid..... **$2.00**

New 1948 Manual

Be prepared to repair quickly all new **1948** receivers. In this big single volume you have clearly-printed, large schematics, needed alignment data, replacement parts lists, voltage values and information on stage gain, location of trimmers and dial stringing, for almost all recently released sets. A worthy companion to the 7 previous volumes used by over 120,000 shrewd radio servicemen. New manual covers models of 42 different manufacturers. Giant size: 8½x11 inches, 192 pages + index. Manual-style binding. Bargain price, only **$2.00**

YOU CAN SERVICE ALL OLDER RADIOS WITH

1947 1946 1942 1941 1940 1939 | 1926-1938

MOST-OFTEN-NEEDED RADIO DIAGRAMS

Each manual has between 192 and 208 pages of diagrams and service hints; large size, 8½x11". Price, each **$2.00**

DIAGRAMS 240 Pages Price $2.50

Record Changer Manuals

Post-War Models

Service expertly all modern (1945-1948) record changers. Just follow simplified factory instructions to make needed adjustments and repairs. Hundreds of photographs and exploded views; thousands of test hints; service instructions for all popular makes. Large size: 8½x11". 144 fact-filled pages. Available at your jobber or sent postpaid, special price, only.. **$1.50**

Pre-War Models

Just what you need to repair quickly thousands of pre-war (before 1942) automatic record changers, manual units, pick-ups, wireless oscillators, recorders, and combinations. Hundreds of mechanical and electrical diagrams. Instructions for adjustments and repairs. Most popular units of all makes. 128 large pages; size: 8½x11 inches. Price postpaid, only **$1.50**

See Your Radio Jobber or Send Coupon →

Supreme Publications

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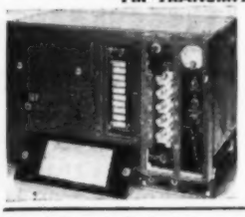
FM TRANSMITTER



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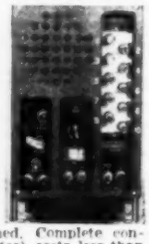

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RT-19/ARC-4, 140 to 144 mc; 4 xtal controlled channels. Super-het receiver has 13 tubes, xmitter has 7 tubes including 4 6L6's, 832A final. With all tubes, xtals, shock mount, dynamotor, control box, diagram, orig. crates,
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Cross-reference tube list—Army VT Numbers to commercial types. Price 50c
Schematic diagrams for SCR274N; ART-13; BC375; BC191; BC221B, J, O, or R; BC348C; SCR269G; SCR522; BC721 Handi-Talkie; R19A/TRC-1; T14A/TRC-1; RT7/APN-1; ARC-1; RA34; BC611 Handi-Talkie; BC312N or NX; BC324N; BC314G; BC344D; BC659; BC603; BC604, Each.....$1.00

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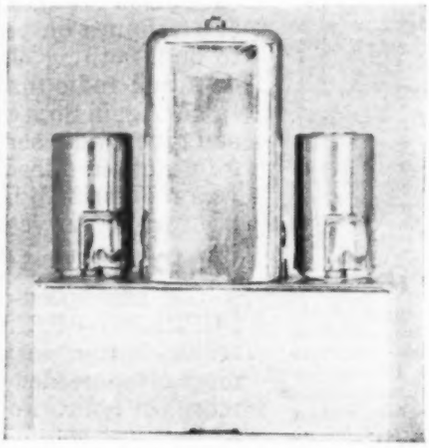
317-R East 2nd St. Tulsa 3, Oklahoma

dynamic speaker. Operation is from 110 volts a.c. or d.c.

Further details may be secured from *Electric Eye Equipment Company*, 8 West Fairchild Street, Danville, Illinois.

NBFM ADAPTER

By means of their newly-developed NBFM adapter, *Schuh's Radio Parts* of Chicago advises that any AM re-



ceiver can now be adapted to narrow-band FM to provide noise-free reception of amateur communications.

Available in two models 455-465 kc. and also 915 kc. for use with BC-348 receivers, this unit is small and compact. Designed for simple mounting in a variety of positions, the unit is completely chrome plated. A 6AK5 is used as a limiter while a 6AL5 serves as a discriminator. Complete instructions for attaching the unit are provided.

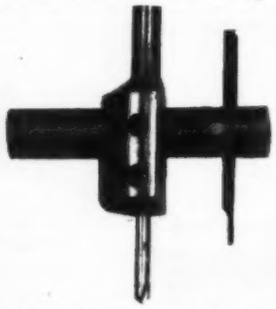
Full details will be supplied on request by *Schuh's Radio Parts*, 1253 Loyola Avenue, Chicago 26, Illinois.

CIRCLE CUTTER

Pittsburgh Coil Company of Carnegie, Pennsylvania, manufacturers of radio equipment, have added a unique circle cutter to their line of products.

This tool has been designed to cut servicing time in the workshop. The cutter is available in two sizes to take care of most circle cutting needs. The unit has a pin which keeps the tool from slipping when used in a hand brace. As this pin is removable, the cutter may also be used with an electric drill or drill press.

Furnished with a small adjustment



wrench, the *Pitco* circle cutter can be utilized to cut any desired radius from ⅝" to 6½". Adjustment for depth of cut is also possible with this wrench.

The company, *Pittsburgh Coil Company*, will supply further details to those writing them at Carnegie, Pennsylvania.

THERMISTORS

The *Metallurgy Division* of *General Electric Company's Chemical Department* is currently introducing a line of Thermistors which will be available in the form of rods, discs, and beads.

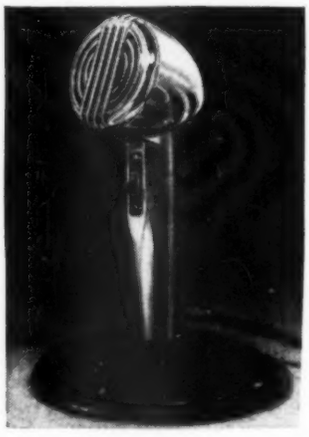
Especially adaptable as the sensitive element in flow meters, time delay relays, switching devices, and other types of indicators and controls, these units can be used with either a.c. or d.c. current.

These Thermistors may be actuated either by ambient temperatures or by internal heating of the element. The negative coefficient of resistance of these units may be used to offset the positive coefficient of resistance of conventional types of electrical conductors, and they can be used in instruments, meters, or other circuit components to correct errors caused by extreme temperature conditions.

Additional information on these new Thermistors may be secured from the *Metallurgy Division, Chemical Department, General Electric Company*, Pittsfield, Massachusetts.

CRYSTAL MIKE

The Astatic Corporation has just introduced a new convertible type crystal microphone which features a de-



tachable "quick-lock" base. This feature permits the microphone to be used as a hand or desk mike or to be mounted on a floor stand.

The "Velvet Voice" is made with bright chrome grille, gold finished housing and handle, and dark brown baked enamel base. The unit is supplied in two models; the No. 200 provides a frequency response characteristic from 30 to 10,000 c.p.s. while the No. 241 has a similar range but with rising characteristics between 1500 and 5500 c.p.s. Either model may be supplied with or without switch.

The Astatic Corporation, Conneaut, Ohio has further details available on these two models.

TV CABINETS

In response to the demand for cabinets suitable for housing television receivers constructed from kits, the *Tel-*

(Continued on page 146)

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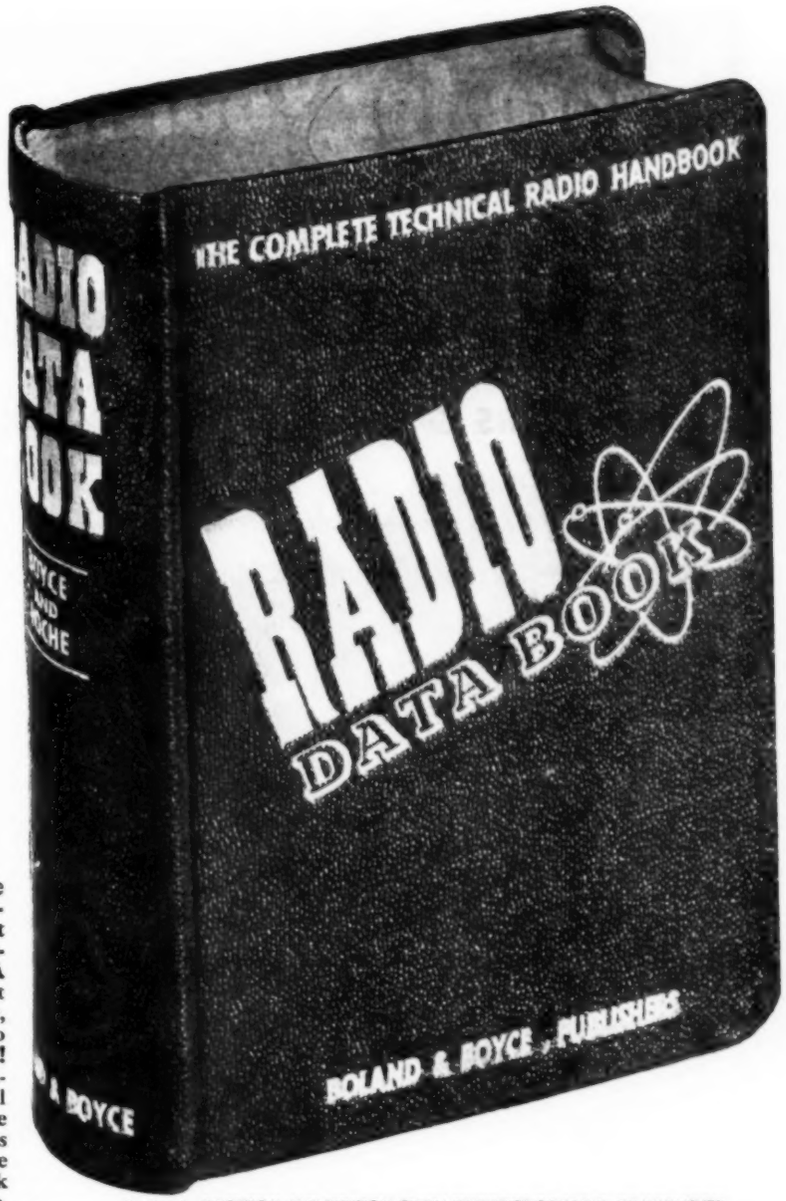

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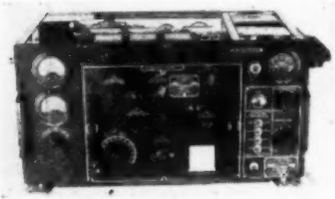
This sensation of all surplus is not only an ideal 10 Meter Mobile Rig! It's a complete amateur radio station! Here are a few more ways to use the equipment included in this Command Set. The transmitter VFO driver stage gives your BC-375-E higher RF output—as high as 150 watts. Make swell standby receivers with the BC-348 on round-table "rag chews." You get all this equipment: 3 Receivers—190-550 kc, 3-6 and 6-9.1 mc; two transmitters, 4-5.3 mc, 5.3-7 mc; four dynamotors—28 volts DC input; 1 modulator with carbon mike input; two tuning control boxes; one antenna coupling box with r-f ammeter; antenna relay and 5000 volt 50 mmfd. WE vacuum condenser (antenna relay can be used with most rigs); and a complete set of tubes for each unit—29 POPULAR TUBES in all. Mechanical cables for remote tuning of receivers supplied for $1.00 extra.

Be sure to write for details of our complete AMATEUR RADIO STATION



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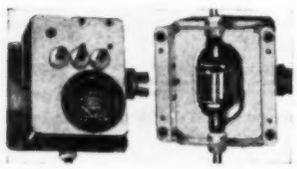
125 watt xmtr., self-contained AC, 400 cycle power supply; uses suppressor grid modulation for phone, VFO controlled, 803 in final; built of std. parts. **$17.50**



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Data on conversion, with schematic diagrams, instructions, and discussion, on the following:

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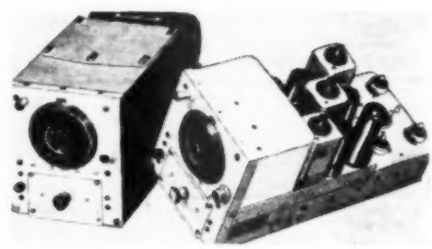

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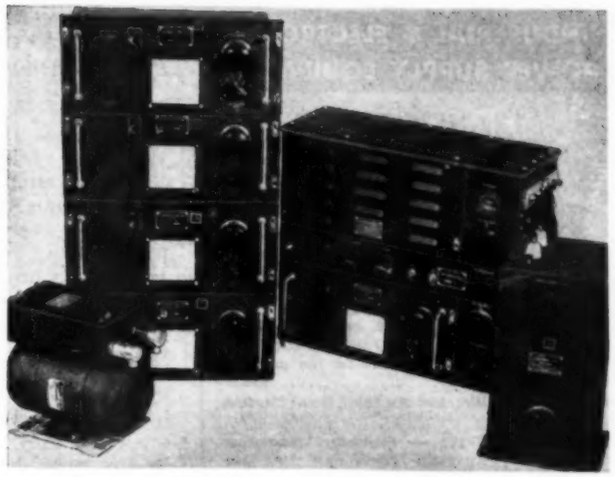

HEADPHONES

69c

HS-33 with cord and plug, 600 ohms — Used, in A-1 condition.

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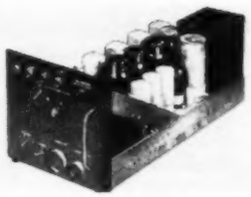

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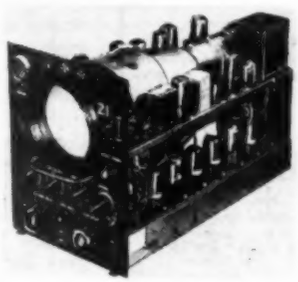

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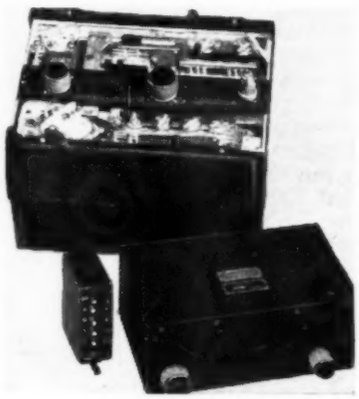

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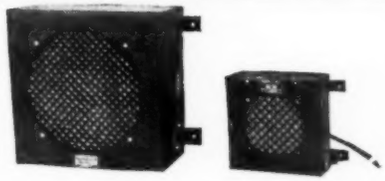

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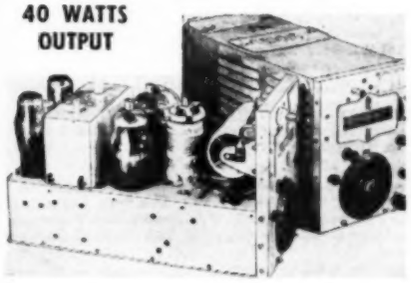

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(RA-38) 115 V., 60 cyc. input, adjustable output 0-15,000 V. A.C. or D.C. @ 500 Mils. Shipping weight 2100 lbs.. $200.00

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1527 E. Seventh Street **EPCO** Los Angeles 21, California

Wave Shaper

(*Continued from page* 44)

opposite result is obtained. The negative half-cycles of sine wave input voltage cannot increase to a value higher than the voltage of cell B_2, with the result that the negative peaks level off at that potential. However, the positive half-cycles are free to increase, and the essentially positive output pulses shown in Fig. 3D are obtained.

When both switches, S_1 and S_2, are closed, both positive and negative half-cycles are clipped simultaneously, as they were limited separately in the preceding examples. The output under these circumstances then is an essentially square wave, such as is shown in Fig. 3E. For best squareness, the sine wave input voltage must have an r.m.s. value of 30, although at lower voltages the output waveform is sufficiently square for a number of test purposes. Only a few audio oscillators available to the serviceman and amateur deliver as high as 30 volts output. However, it is comparatively easy to connect a suitable stepup transformer between the low-voltage oscillator and the "*INPUT TERMINALS*" of the shaper.

With each type of output (See Fig. 3), the amplitude of the output signal may be adjusted to a desired level by means of the output potentiometer, R_2.

When the shaper is not in use, both switches may be thrown to their open position, to prevent continuous drain of the dry cells through the crystals in series.

Construction

Small-sized parts were employed in the construction of the author's shaper unit. The photographs, Figs. 1 and 2 show external and internal assembly of the device. The metal case is a 4"x5"x2¾" "instrument box." It is not necessary to employ this same size in duplicates, however. A much smaller housing might have been used, but the particular box shown in the photographs simply happened to be in shop stock.

The experimenter who is interested solely in obtaining square waves from his audio oscillator and who has no need for the positive or negative pulses, might build an extremely small version of the shaper (with a single d.p.s.t. toggle switch to close both rectifier legs simultaneously) as an "adapter" to be plugged directly into the oscillator output terminals.

A *Sylvania* type 1N35 dual crystal diode is shown. This unit furnishes the two required crystals in a convenient mounting bracket. If an individual builder desires, two separate 1N34 crystals can be used.

As can be seen in Fig. 2, the pen-size dry cells are held to one inside wall of the case by a curved spring clip made of flat brass stock. The toggle switches are mounted through the top cover of the case, the output control potentiometer through the front edge, and the insulated binding post blocks through opposite "end edges."

Wiring is simple and straightforward, but it is imperative that proper polarity of both the crystal diodes and the dry cells be observed.

If considerably higher sine wave input voltages must be handled, and higher battery voltages are to be used, selenium rectifiers may be substituted for the crystal diodes shown in Fig. 3.

Adjustment

After the shaper is completed and all wiring verified, the unit may be tested by feeding a sine wave voltage (power or audio frequency) to the shaper "*input terminals*" and connecting the shaper "OUTPUT TERMINALS" to the vertical amplifier input terminals of an oscilloscope. Throw both switches in the shaper to their "*off*" (open) position, set potentiometer R_2 for maximum output, and set the oscilloscope controls for internal sweep and internal synchronization.

With both shaper switches open, the sine wave pattern of Fig. 3B should be seen on the oscilloscope screen. Run potentiometer R_2 from one end of its range to the other to check its control of the output signal amplitude from zero to maximum. Then, reset R_2 for maximum output.

Close shaper switch S_1 only, noting that the positive peaks, as viewed on the scope screen, are clipped as in Fig. 3C. Open switch S_1 and close switch S_2, noting now that the negative peaks are clipped, as shown in Fig. 3D.

Close both shaper switches, S_1 and S_2, noting that both positive and negative peaks are clipped, as shown in Fig. 3E.

If the foregoing results are not obtained, and the wiring is found to be correct, it is very likely that the polarity of the cells or crystals, or both, have been reversed.

Operation

Connect source of sine wave voltage (audio oscillator or 60-cycle transformer secondary) to "INPUT TERMINALS" of shaper. Connect shaper "OUTPUT TERMINALS" to oscilloscope or to device (such as audio amplifier or network) under test.

Sine Wave Output. Open both shaper switches and adjust potentiometer R_2 for desired output signal strength.

Positive Pulse Output. Close shaper switch S_1, leaving S_2 open, and adjust potentiometer R_2 for desired output signal strength.

Negative Pulse Output. Close shaper switch S_2, leaving S_1 open, and adjust potentiometer R_2 for desired output signal strength.

Square-wave Output. Close both shaper switches and adjust potentiometer R_2 for desired output signal strength. —30—

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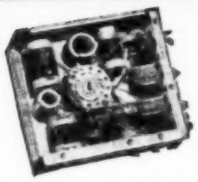

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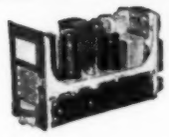

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kc	kc	kc	kc	kc	kc	kc	kc	kc	kc	kc
412	420	429	437	445			479	490	497	506	516
413	422	430	438	446		470	481	491	498	507	518
414	423	431	440	447	459	472	483	492	501	508	519
415	424	433	441	448	462	473	484	493	502	509	522
416	425	434	442	451	463	474	485	494	503	511	523
418	426	435	443	453	466	475	487	495	504	512	
419	427	436	444		468	477	488	496	505	515	

49¢ each

I.F. Frequency Standards	Crystal Frequency Standards 98.356kc	For Crystal Controlled Signal Generators 525kc
kc kc kc	Easily altered for	526.388 531.944 536.111
450 454.166 461.111	100 kc Standard	527.777 533.333 537.500
451.388 464.815	Mounted in low	529.166 534.722 538.888
452.777 459.259 465.277	loss 3 prong	530.555
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370kc	376kc	381kc	384kc	387kc
372	377	383	386	388
374	379			
375	380			

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391	396	403	406	409
392		404	407	411
393	398			
394	401			

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1A7GT	1.08	6BA6	1.08	12H6	.90
1B4P	1.08	6BE6	1.08	12J5GT	.81
1B5/25S	1.08	6BF6	.90	12J7GT	.90
1C5GT	1.08	6C5	.90	12K7GT	.81
1C6	1.08	6C6	.80	12K8	1.32
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1E7G	1.92	6D6	.80	12SC7	1.00
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1F6	1.32	6D8G	1.32	12SF7	1.08
1G4GT	1.08	6E5	.90	12SG7	1.00
1G5G	1.08	6F5	.90	12SH7	1.08
1G6GT	1.32	6F6	.90	12SJ7GT	.90
1H4G	.81	6F7	1.32	12SK7GT	.90
1H5GT	.90	6F8G	1.00	12SL7GT	1.32
1H6G	1.08	6G6G	1.00	12SN7GT	1.08
1J5G	1.59	6H6	.75	12SQ7GT	.90
1J6G	1.08	6J5	.75	12SR7	.90
1L4	1.92	6J6	1.59	12Z3	.81
1LC6	1.92	6J7	1.08	14A7/12B7	1.30
1LB4	1.92	6K6	.80	14G6	1.32
1LH4	1.92	6K7	.90	14H7	1.32
1LN5	1.92	6L5G	.90	14Q7	1.08
1N5GT	1.08	6L6G	1.50	25L6GT	.90
1Q5GT	1.32	6L7	1.32	25Z6GT	.81
1R5	1.25	6N7	1.32	26	.63
1S4	1.25	6Q7	1.08	27	.57
1S5	1.25	6R7	1.32	30	.81
1T4	1.25	6SA7	.80	31	.81
1T5GT	1.32	6SA7GT	.90	32L7GT	1.59
1V	.81	6SB7-Y	1.59	35	.81
2A6	.81	6SC7	1.00	35L6GT	.81
2B7	.75	6SF5	.70	35W4	.69
2E5	1.08	6SF7	1.08	35Z3	1.08
3ABCT	1.59	6SG7	1.08	35Z4GT	.66
3Q5GT	1.32	6SH7	.90	35Z5GT	.69
3S4	1.25	6SJ7GT	.75	36	.81
5T4	1.50	6SK7	.80	37	.69
5U4G	.81	6SL7GT	1.10	38	.90
5V4G	1.32	6SN7GT	.90	39/44	.75
5W4	.90	6SQ7	.80	41	.69
5X4G	.90	6SR7	.80	45	.66
5Y3GT	.57	6SS7	.80	45Z3	.90
5Y4G	.63	6U5/6G5	1.08	46	.90
5Z3	.90	6U7G	.81	50A5	1.50
5Z4	1.80	6V6	1.35	50B5	1.08
6A4	1.32	6W7G	1.10	50L6GT	.90
6A6	1.25	6X5GT	.81	55	.50
6AB	1.08	6Y6G	1.10	56	.66
6AB5/6N51	1.32	6Y7	1.08	59	1.32
6Ab7/1853	1.50	6V7G	1.08	75	.69
6AC5GT	.90	6ZY5G	1.00	76	.75
6AC7/1852	1.80	7A4	1.00	77	.75
6AD6G	1.32	7A5	1.00	78	.75
6AD7G	1.32	7A7	1.00	79	.44
6AE8GT	1.08	7C7	1.08	80	.57
6AE6G	1.08	7E6	1.08	85	.75
6AF6G	1.32	7E7	1.32	89	.50
6AG5	1.92	7F7	1.32	117L7GT/ 117M7GT	1.92
6AG7	1.92	7H7	1.30	117Z3	1.08
6AK6	1.32	7J7	1.59	117Z6GT	1.32
6AL5	1.08	7K7	1.32	XXb	1.32
6AQ5	1.08	7Q7	1.08	XXFM	1.32
6AQ6	1.08	7Y4	1.08	VR-90/30	1.92
6AT6	.90	12A5	.90	VR-105/30	1.92
6AU6	1.08	12A6	1.32	VR-150/30	1.92
6B4G	1.30	12BGT	.81	182B	1.92
6B6G	.90	12AH7GT	1.32	485	1.92
		12AT6	.90	1619	1.50
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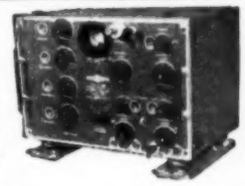

These can be easily converted to 20-40-80 meters. Crystal required for 10 meters. Each electronic coupled oscillator dial has 3000 divisions enabling quick precision shifting. This transmitter was constructed of the highest quality of precision parts, with laboratory precision. Four separate output tanks; one 4-position selector channel switch having seven sections which changes the ECO, IPA and output tanks simultaneously. All the controls are mounted on the front panel. The housing is cast aluminum; shields and case are sheet aluminum. Dimensions 11 x 12 x 15 inches, weighing 35½ lbs. Complete, simple instructions for conversion furnished. Uses three 807, four 12SK7 tubes; one 2-inch 5 amp. R.F. meter.

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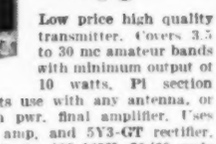

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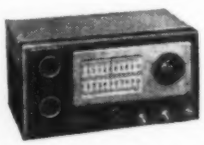

MARINE REC. S 51

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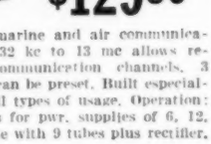

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FM SIGNALS Received in Australia

By CHARLES LYNCH

General details of a home-built receiver that has logged many FM stations in the United States.

A HOME-MADE radio receiving set, designed by an Australian radio mechanic, which has been receiving FM signals and messages from stations in the United States, has aroused much interest in trade circles in various countries. This set was constructed by Frank Graham of Lower Plenty Road, Rosanna, a suburb of Melbourne, capital of the State of Victoria.

Mr. Graham discounts some suggestions that his receptions are freakish. He states that since September 1946, when he made the set at home in his spare time, more than 200 stations have been logged on a number of frequencies from 30.7 to 39.9 mc. Of these, approximately 100 would be on FM. They comprised police, special emergency messages, such as forestry and fire department signals.

The v.h.f. has been heard throughout the past 12 months, Mr. Graham says. The best periods for reception were from September to early December, and in March and April. Lower frequency bands (30.33 mc.) were the more consistent, though when the higher frequency bands (35.39) did open up they provided some splendid signals.

Reports were forwarded to many of the stations, and a considerable number of verifications have been received. In almost every case it was acknowledged that the report was the first received from Australia.

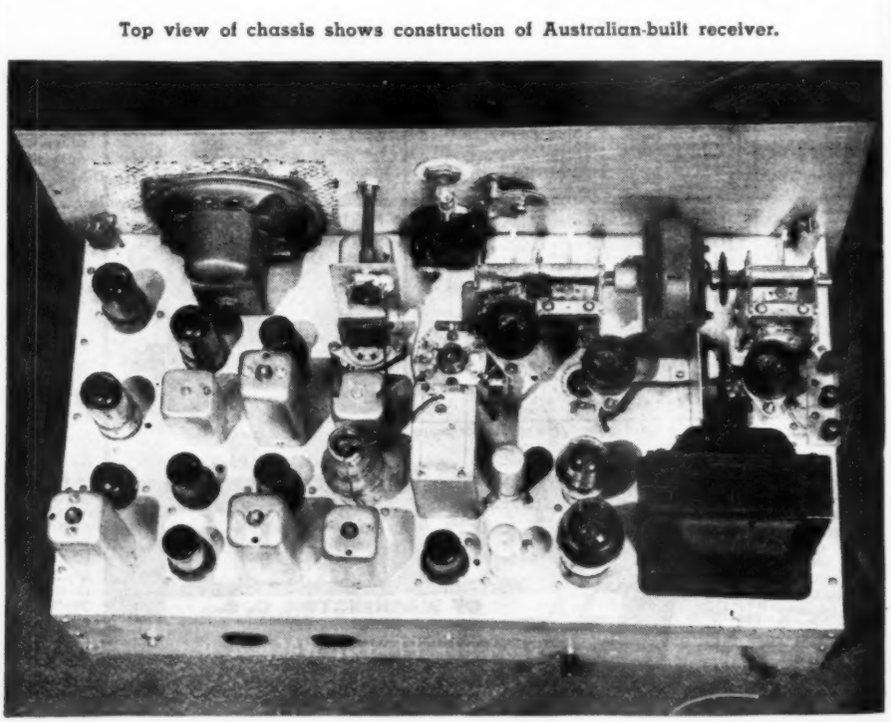
Mr. Graham provided the following data on his set which should be of interest to technicians.

The set is a 15-tube combined AM/FM receiver, with tube line-up as follows—6AK5 r.f.; 954 mixer; 955 oscillator; 6J8 second mixer; 6SK7 i.f.; 6SK7, i.f.; 6SJ7 first limiter; 6SJ7 second limiter; 6H6 discriminator; 6SJ7 tone control; 6SJ7 audio; 6V6 output; 5V4 rectifier; VR150 voltage regulator; and 6C5 "R" meter tube.

The 6AK5 is used under maximum voltage conditions, and seems to have good gain up to at least 100 mc. The 954 is used with grid injection from the 955 oscillator; a 2 $\mu\mu$fd. condenser being used to couple both grids. Plug-in coils, wound on 807 micanol tube bases, are used with the oscillator frequency 5 mc. higher than the signal frequency. Two sets of coils are used to cover the police and amateur bands —tuning from 55-40 mc., and from 40-22 mc. respectively.

The 954 is coupled to the 6J8 second

Top view of chassis shows construction of Australian-built receiver.



mixer through a 5 mc. i.f. transformer. The oscillator section of the 6J8 is tuned to a fixed frequency of 5 mc. plus 455 kc. with a crystal oscillator. The 6J8 is coupled to the first 6SK7 through a 455 kc. crystal filter i.f., and a 5 mc. i.f. wired in series. The crystal filter is a variable selectivity *Hammarlund* type. The 6SK7 is coupled to the second 6SK7, and the second 6SK7 to the first limiter through 455 kc. and 5 mc. i.f.'s wired in series. The 6SJ7 first limiter has a grid resistor and condenser in the grid return. The a.v.c. for both FM and AM is taken from the voltage developed across this resistor, which also acts as diode load for AM. The first limiter is resistance-coupled to the second limiter. The screen and plate voltage of both limiters is 20 volts to give good limiting on weak signals. A standard Foster-Seeley discriminator is used. The tone control tube is of the voltage divider type with a large amount of high frequency attenuation, .002 μfd. coupling condensers are used for bass attenuation to get maximum intelligibility on speech. The output of the 6V6 is fed to a 5-inch speaker which is built-in.

The FM/AM switch has three positions—narrow-band AM, with a 455 kc. i.f. channel and crystal filter; wide-band AM, with a 5 mc. i.f. channel; and FM, with 5 mc. i.f. channel and approximate bandwidth of 40 kc.

In the narrow-band AM position the plate voltage to the 6J8 oscillator section is switched on. The plate and screen supply to the first limiter is switched off, and the 6SJ7 acts as a diode detector with the audio output switched to the diode load.

For the wide-band AM the plate voltage to the oscillator section of the 6J8 is switched off, and this tube functions as a straight i.f. amplifier at 5 mc., followed by the two 6SK7's as i.f. amplifiers at 5 mc.

In the FM position the voltage to the limiters is switched on, and the audio output is taken from the discriminator.

The 5 mc. i.f.'s have 50 turns #32 enamel wire primary and secondary on ½-inch formers, spaced ½-inch apart and slug tuned. The discriminator i.f. has 40 turns on the primary and 60 turns, center tapped on the secondary—the secondary being at right angles to the primary, and spaced ⅜-inch apart.

The VR150 regulates the voltage to the 955 oscillator plate, 6J8 oscillator plate, and 6C5 "R" meter tube plate.

At present no special antenna is used for the v.h.f. bands. An L-type, approximately 60 feet in length, has been found to give quite satisfactory results.

—30—

PUEBLO SERVICEMAN'S ASSOCIATION

BY R. C. TRAVERS

FOR MANY years servicemen's associations have been a subject of controversy. However, the Pueblo Serviceman's Association has adopted a program which could very well serve as a blueprint for other associations in the United States to follow.

There are, at present, twenty-seven members of the Pueblo Serviceman's Association, all of whom are radio technicians. Before being accepted for membership in the association, all candidates must pass a two-part examination. The first part of the test consists of fifty "true and false" questions while the second part is a so-called "practical" examination.

Questions for the written examination are submitted by the membership. Each member formulates three questions covering radio servicing and from this group of questions fifty are chosen to comprise the examination.

Each serviceman, as a condition of membership, has to take a new examination every year. These examinations include questions involving television, FM, wire recording, etc.

Association members are required to adopt certain standards of shop operation. A service fee of $1.75 per hour has been adopted as standard by the organization and members must agree not to cut this fee nor indulge in unfair competition. Members of the association are further required to present customers with itemized service invoices showing the nature of the services rendered, the cost of parts, and the period of the service guarantee, if such applies.

Members have access to the association's library which houses copies of schematic manuals, latest volumes covering television, FM, etc. In addition, the group has just purchased a television kit and weekly association meetings feature a discussion of practical video circuit techniques from the service standpoint. Each member of the association is privileged to use the kit in the association laboratories for one three-hour period a week. The laboratories are equipped with a beat oscillator, cathode-ray oscilloscope, tube tester, set analyzer, wire and voice recorder, and three test benches. Association members may use the laboratory facilities for a period not to exceed three hours per week.

The organization cooperates in sponsoring newspaper ads and spot announcements on the radio. Each member has a radio spot dedicated to his shop some time during the week.

An inspection committee, consisting of four members, visits each member-shop quarterly to determine whether or not association standards with regards to shop cleanliness are being met. Shops which meet the standard are given a clean bill of health, those falling below par are given thirty days in which to correct the condition after which membership in the association is withdrawn. The standards are neither over-elaborate or burdensome. They consist of keeping the shops clean and free from junk.

The association meets once a week on Wednesday evenings from seven to ten-thirty. Dues are $0.50 a week which sum goes toward the rental of laboratory space, etc. An assessment of $1.00 a month is paid by every association member to cover the cost of the laboratory equipment.

Although the group is relatively small at the present time, applications for new memberships are being received in heartening numbers. —30—

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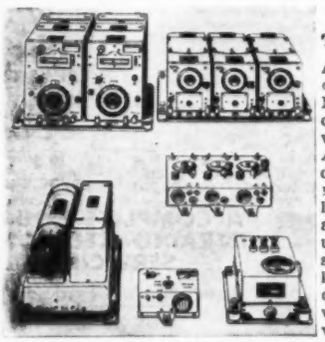
The above ten assortments totaling over $12.00 at the unbelievable bargain prices listed can be purchased together as one lot at a super-special total price of only $10.00. All merchandise guaranteed to be as advertised.

RT1463 7 tube amplifiers containing 3—7F7, 1—7Y4, 3—7N7. 4 potentiometers, numerous resistors, filter and bypass condensers, filter chokes, power and audio transformers, and six sensitive plate relays. A military development that provided amazing stepless control proportional to correction required for ailerons, rudder and elevator, in the original application. A control amplifier of the ordinary type would deflect the rudder by some arbitrary amount when the ship was blown off the course to port or starboard. The result would either be that the correction was insufficient and the plane continued off course, or the correction would be too great, starting a series of tackings and would greatly increase fuel consumption and elapsed time in reaching the objective. This phenomenal unit, with its 3 amplifiers and six 5000 ohm relays in bridge circuits, will accurately control any 3 operations, related or unrelated, in minutely adjustable uniquely quantitative variations in either forward or reverse directions. 9"x7"x8" black crackle aluminum case. Brand new in original carton. **$9.95.**



SCR-274N COMMAND SET

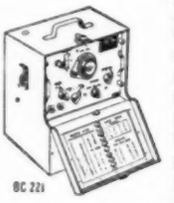
The greatest radio equipment value in history

A mountain of valuable equipment that includes 3 receivers covering 190 to 550 KC; 3 to 6 MC; and 6 to 9.1 MC. These receivers use plug-in coils, and consequently can be changed to any frequencies desired without conversion. Aso included are two Tuning Control Boxes; 1 Antenna Coupling Box; four 28 V. Dynamotors (easily converted to 110 V. operation); two 40-Watt Transmitters including crystals, and Preamplifier and Modulator. 29 tubes supplied in all. Only a limited quantity avaiabe, so get your order in fast. Removed from unused aircraft and in guaranteed electrical condition. A super value at **$29.95**, including crank type tuning knobs for receivers. Without these knobs the receivers can't be tuned, and are only useful for parts. Don't buy without knobs! We also include one 60 cycle, 110 to 24 volt filament transformer for receiver—FREE.

RECORDING AMPLIFIER. 3 stage, 110 V, 25 or 60 cycle high gain amplifier built by recently bankrupt manufacturer specifically for recording use. Transformer for low impedance wire recorder head and magnetic cutter included on chassis. Tone and volume controls and switches on chassis for playback, recording or use as public address amplifier. Complete with tubes **$9.95**

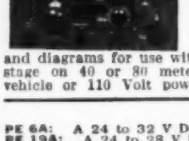
Aluminum gear box 18x8x7 that contains two powerful electric motors and two matched gear trains, 62 gears in all varying in size from ½ to 4 inches in diameter. This unit is readily converted to rotate a beam antenna or any other similar usage **$3.00**

BRAND NEW 110 V AC INPUT POWER SUPPLY, in grey enameled shock-mounted case 9" x 10" x 16". Several heavy duty resistors, 3 chokes, 4-1000 V and 600 V oil-filled condensers, 1 relay, 2-5U4's, 3 voltage regulator tubes, safety interlock, and several fuses are included in this regulated power supply at the bargain price of..... **$9.95**



BC-221 FREQUENCY METERS with calibrating Crystal and calibration charts. A precision frequency standard that is useful for innumerable applications for laboratory technician, service man, amateur, and experimenter at the give away price of only **$36.95.**

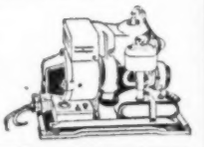
100 KC crystal calibrator kit containing everything that is necessary to construct a 100 KC osc. that will supply 100 KC marker points to your receiver so that it may be used for frequency determination. The 100 KC crystal is worth far more than the price that we are asking for the complete kit.
Kit 100K Plate and fil voltage supplied by receiver **$9.95**
Kit 100KA Same as above, including 110 VAC or DC self-contained power supply... **$12.95**



SCR-284 TRANSMITTER-RECEIVER—This medium power transmitter and the accompanying 7-tube very sensitive receiver are naturals for 80 or 40 meter operation (phone or CW), on either fixed stations or mobile applications. These units are brand new and come complete with 17 tubes, key, microphone, 200 KC calibrating crystal and instructions and diagrams for use with up to 100 watts input to the final stage on 40 or 80 meters for either phone or CW, using vehicle or 110 Volt power supply. Your cost.....**$39.95**

PE-109 32-VOLT DIRECT CURRENT POWER PLANT

This power plant consists of a gasoline engine that is direct coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run many of the surplus items that require 24-32V DC for operation. **The price of this power plant is only $58.95.** We can also supply a converter that will supply 110V AC from the above unit or from any 16-32V DC source for **$12.95.**



BRAND NEW INVERTERS AND DYNAMOTORS

PE 6A: A 24 to 32 V DC input, to 80 V AC regulated output converter—**$12.95.**
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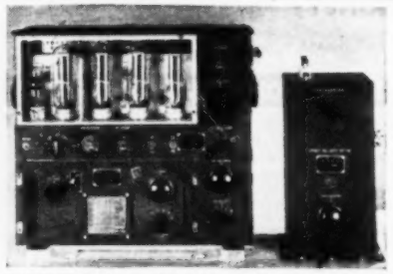
(We include a stepup transformer with each of the above so that 110 VAC is available from either.)
27 V DC input 285 V DC @ 75 MA output—**98c.**
27 V DC input. Output 300 V @ 150 MA, 150 V @ 15 MA and 12 V @ 5 Amp—**$5.95.**
12 V DC input. Output 300 V @ 150 MA, 150 V @ 15 MA and 12 V @ 5 Amp—**$12.00.**
13 or 26 V DC input. Output 800 V DC, 400 V DC @ 135 MA, and 9 V AC—**$15.00.**
(By running on 6 V AC, 60 cycle input, with a small amount of DC for field excitation, the above dynamotor will provide a good source of 12, 24, 400 or 800 V DC.)

GENERAL ELECTRIC RT-1248 15-TUBE TRANSMITTER-RECEIVER

TERRIFIC POWER—(20 watts) on any two instantly selected, easily pre-adjusted frequencies from 435 to 500 Mc. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's, as first detector and oscillator, and 3—7H7's as IF's, with 4 slug-tuned 40 Mc. IF transformers, plus a 7H7, 7E6's and 7F7's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12 volt operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for use in mobile or stationary service in the Citizen's Radio Telephone Band where no license is necessary. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice in AM or FM transmission or reception, for use as a mobile public address system, as on 80 to 110 Mc. FM broadcast receiver, as a Facsimile transmitter or receiver, as an amateur television transmitter or receiver, for remote control relay hookups, for Geiger-Mueller counter applications. It sells for only **$29.95** or two for **$53.90.** If desired for marine or mobile use, the dynamotor which will work on either 12 or 24V DC and supply all power for the set is only $15.00 additional.

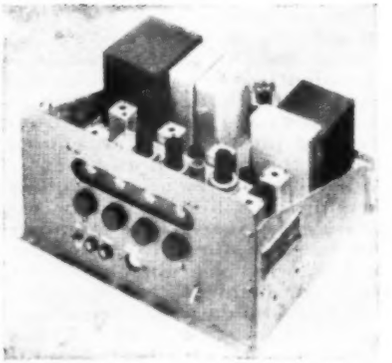


GENERAL ELECTRIC 150 WATT TRANSMITTER

Cost the Government $1800.00
Cost to you $44.50!!!!

This is the famous transmitter used in U.S. Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: FREQUENCY RANGE: 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification.) OSCILLATOR: Self-excited, thermo compensated, and hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½x23x9¼ inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, five tuning units, antenna tuning unit and the essential plugs. These units have been removed from unused aircraft but are guaranteed to be in perfect condition.

14-Tube UHF Superhet Receiver — $39.95



This beautifully constructed receiver was designed especially for Signal Corps communication service, and is one of the finest and most sensitive sets ever manufactured. Operating from 110V 60 cycles, this set has two tuned RF stages, tuned converter and oscillator, **five I.F.** stages, using iron-core I.F.'s a diode detector, tuning eye, and a two stage amplifier that will drive a speaker or phones. The frequency range is 158-210 Mcs. It is a simple matter to operate on other bands by making a slight alteration in the tuning coils. A complete set of tubes is included with each receiver, along with a circuit diagram and parts list. The high-voltage power supply delivers 150 milliamperes, and is well filtered by a heavy-duty choke and three 7 Mfd. oil-filled condensers. This buy of a lifetime cost the government about $700. Amateurs and experimenters will never again be able to purchase fine equipment at such a tremendous saving! See January **Radio-Craft**, Page 57, for complete conversion to television receiver.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 5-N BUFFALO 3, N. Y.

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All of our car radio antennas are made of triple plated Admiralty Brass Tubing, complete with low loss shielded antenna leads and high quality fittings.

SIDE COWL—BR-1, 3 sections extend to 66". Your price—single units—**$1.50**; in lots of 12—**$1.35** ea.

SKYSCRAPER—BR-2 has 4 heavy duty sections that extend to 98". Your price—single units—**$2.45**; in lots of 12—**$2.25** ea.

TILT ANGLE—BR-3, may be adjusted to all body contours. 3 sections extend to 66". Single unit price—**$1.50**; 12 lot price—**$1.25** ea.

VERSATILE—BR-4, single hole fender or top cowl mounting may be adjusted to conform with all body contours. 4 sections extend to 56". Single unit price—**$2.90**; 12 lot price—**$2.75** ea.

THE MONARCH—BR-5, single hole top cowl mounting, 3 sections extend to 56". Single unit price—**$1.90**; 12 lot price—**$1.75** ea.

After Seeing our Antennas and Comparing, You Will Never Buy Any Other Make!

BR1 BR2 BR3 BR4 BR5

BENDIX SCR 522—Very High Frequency Voice Transmitter-Receiver—100 to 156 MC. This job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't $2500.00. Crystal Controlled and Amplitude Modulated—HIGH TRANSMITTER OUTPUT and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles at high altitudes. Receiver has ten tubes and transmitter has seven tubes, including two 832's. Furnished complete with 17 tubes, remote control unit, 4 crystals and the special wide band VHF antenna that was designed for this set. These sets have been removed from unused aircraft and are guaranteed to be in perfect condition. We include free parts and diagrams for the conversion to "continuously variable frequency coverage" in the receiver.
The SCR 522 complete with 24 volt dynamotor sells for only **$37.95**. The SCR 522 is also available with a brand new 12 volt dynamotor for only **$42.95**.

$9.95 TAKES ALL THREE BIG BARGAINS

1. AUDIO AMPLIFIER Undreamed of value. Uses 6V6's. Has 4 microphone inputs brought to jacks at rear panel. Various output impedances available at rear panel connections. Steel case with chrome handles, 9" long x 9" high x 6" deep. Tubes included. New in original carton. Shipping weight 20 lbs. **SUPER SPECIAL—$4.95** while supply lasts.

2. RADIO HEADSETS Latest supersensitive type with rubber earpieces. Every pair guaranteed perfect. **$.59 per pair OR 3 PAIRS FOR $1.00.**

3. HOME WORKSHOP AT BARGAIN PRICE

Accurate and precise 2 speed guaranteed hobby lathe, the essential machine for the home workshop. Sturdy enough for light production work or factory standby service, supplied with 56" of belting for connecting to any available electric motor or power take-off, such as on a jeep or tractor. Also included in this unbelievable offer are such accessories as a ½" drill chuck with specially hardened tool steel jaws, a 4" electric furnace high speed grinding wheel, a cotton buffing wheel with a large supply of buffing compound, and a 4" steel wire scratch brush. Your cost $6.00. Sole export agent. Distributor inquiries invited.

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AUTO RADIO DEALERS! ATTENTION!

Nationally advertised brand of 1948 car radio which will fit practically any car and every pocketbook. Six tube superheterodyne with three gang condenser and 6½" speaker. **$32.20 for sample, or Dealer price $29.97 each, in lots of two or more.**
Here is an item that no serviceman who repairs auto radios should be without. Nationally advertised **ATR BATTERY ELIMINATOR** that supplies perfectly filtered 12 VDC or 6 VDC at 14 amp from 110 VAC **$36.00**

RADIO SERVICEMEN!! Buffalo Radio Supply's lower prices mean increased profits for you. Order all of your needs from us and receive in return courteous service and first class merchandise at the lowest prices in the country.

TUBES: all types in stock, 60% off on all tubes if ordered in lots of 10 or more.

TRANSFORMERS—All types in stock. **AUTO-TRANSFORMERS:** Steps up 110v, or steps down 220v to 110v—**$1.95.**
FIL. TRANS.: 6.3v, 20 Amps.—**$1.98**; Universal Output Trans, 8 Watt—**89c**; 18 Watt—**$1.29**; 30 Watt $1.69. **AUDIO TRANSFORMERS:** S. Plate to S. Grid, 3:1—**79c**; S. Plate to P.P. Grids—**79c**; Heavy Duty Class AB or B. P.P. inputs—**$1.49**; Midget Output for AC-DC sets—**69c**; **MIKE TRANSFORMER** for T-17 Shure microphone, similar to UTC ouncer type—**$2.00**. Stancor SB or DB mike to line or grid—**$1.95.**
POWER TRANSFORMERS—Half-shell type. 110V, 60 cy. Centertapped HV winding. Specify either 2.5 or 6.3V filament when ordering.

For 4-5 tube sets—650V, 40MA, 5V & 2.5 or 6.3V	$1.49
For 5-6 tube sets—650V, 45MA, 5V & 2.5 or 6.3V	1.75
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For 9-15 tube sets—600V, 150MA, 5V & 6.3V	2.95

CONDENSERS—PAPER TUBULAR 600 WV—.001, .002, .005—8c; .01, .05—9c; .1—10c; .25—23c; .5—35c; **ELECTROLYTICS:** 8mfd 200v—**20c**; 10mfd 35v—**20c**; 30mfd 150v—23c; 20/20mfd 150v—35c; 30/20 150v—46c; 50mfd 150v—43c; 8mfd 475v—34c; 16mfd 350v—65c; **OIL CONDENSERS:** 4mfd 600v—49c; 2mfd. 600v—29c; 3X 1mfd. 600v—29c.

SPEAKERS—These PM speakers are the finest that are available. All have heavy oversize Alnico V magnets.

3½"	$1.15	6	for $ 6.60
4"	$1.15	6	for $ 6.60
5"	$1.10	10	for $ 9.50
6"	$1.50	6	for $ 8.70
7" (Car Radio Size)	$4.50	6	for $21.50
8" 10 oz.	$3.95	6	for $20.50
8" 21 oz.	$4.95	6	for $26.50
10" 21 oz.	$5.50	6	for $30.00
12" 21 oz.	$7.95	6	for $42.00

FLUORESCENT LIGHT BALLASTS. Single 30 or 40 watts, **$1.68**; Dual 40 watt High Power Factor—**$3.75.**
HEADPHONES—Highest quality Signal Corps headsets with 12" cord and plug **$1.25.** 5' rubber covered patchcords with phone plug and socket—**45c.**
LINE FILTERS—110V—each unit contains two 2 mfd. oil filled condensers and a 15 amp. iron core choke. This filter has innumerable uses such as oil burner line filter, etc. A ten dollar value for **98c.**

RT-1579 consists of a three stage (cascade 6SJ7's and 6F6 output stage high gain, high fidelity amplifier with 60 cycle, 110V power supply on the same 13½x 14½ chassis, which is protected by a substantial steel cover over tubes and parts. Made by Western Electric with typical quality components such as a husky power transformer and oil condensers, this unit is obviously intended to give years of trouble-free service with no more need for repairs than a telephone. Disconnecting one wire each, from the special input and output filters, will result in as high a fidelity amplifier as can be obtained. Your cost with tubes, diagram and parts list included—**$14.95.**

SENSATIONAL SCOOP—Brand new 1948 model 7½ H.P. twin cyclinder outboard motor made by the world's second largest manufacturer of outboard motors. Regular price everywhere **$169.95.** Our amazing price on this hard-to-get item at the peak of the seasonal demand is **$142.95.**

AT LAST YOU CAN AFFORD A LABORATORY STANDARD MICRO VOLTER

The famous Measurements Corp. Model 78B, 5 Tube Laboratory Standard Signal Generator (that sold new, FOB Boonton, N. J., for $310.00 net) is available in perfect condition for 25 to 60 cycle, 115 V AC operation. Until now this is the sort of topflight lab equipment that discriminating buyers have only vainly hoped would be released at a bargain price. Worth every cent the manufacturer asks, but available FOB Buffalo while our limited supply lasts for only **$79.95.**
Such companies as Admiral Corp. and John Meck, Inc., have ordered from us and repeated many times on these 78 generators for use in their labs and production line testing.

Model 78-B Standard Signal Generator. Two Frequency Bands between 15 and 250 megacycles.

"REMEMBER THAT A STANDARD IS ONLY AS RELIABLE AS ITS MAKER."

FILTER CHOKES: 200, 300, 400, 500 ohm light duty—**59c**; 200 or 300 ohm heavy duty—**99c**; 250 ma 35 ohm, made for U.S. Navy; fully shielded—**$1.95**; 75 ohm 125 ma—**25c** or 25 for **$4.25**; "Meissner type" tapped filter chokes—**25c**; 8 amp. iron core A filter—**25c**; Choke-condenser combination, ideal to replace any size speaker field when installing PM speaker—**79c.**
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SELENIUM RECTIFIERS—Dry disc type 1½", 1". 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting DC meters to AC applications, and also may be used in low current chargers—**90c.**
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A HIGH GRADE CRYSTAL PICK-UP WITH THE PURCHASE OF EACH PHONO MOTOR AT $4.95.

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20 ASST'D COIL FORMS, including 11 ceramic, 3 polystyrene, and 6 fiber, all useful sizes—**50c.**
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INTERRUPTION FREQUENCY COILS for super-regenerative receivers or the tremendously popular FM adapters for standard broadcast sets. Iron core with a resonant frequency of 50 KC—**39c**; Air Core, 100 KC—**29c.**
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MODULATION TRANSFORMERS — 10 watt, metal case **98c**; 30 watt, open-type **$1.95**; 40 watt, cast aluminum case, **$2.95**; Class "B" Input transformers, cast aluminum case, **$1.95**; Transceiver audio transformers, **65c**; Transformer modulation transformers, **65c.**

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THE FOLLOWING DESIRABLE ITEMS AT SACRIFICE PRICES TO MAKE ROOM IN OUR WAREHOUSE FOR INCOMING STOCK

5" "SO" RADAR P.P.I. SCOPE, complete with 9 tubes including 807 tube in final power stage that provides deflecting current for magnetic yokes. Selsyn motor and self-contained 110 V. power supply designed to run on the AC supply on LST and PT boats. Various ranges from 2 to 80 miles. The most satisfactory scope available for navigational radar or panoramic television applications. —Nationally advertised as surplus at $100.00 by others. Our price, only **$39.95.**
LORAN INDICATOR OSCILLOSCOPE complete with 26 tubes and a 5" cathode ray tube. Greatly superior to other scopes because the multivibrator circuit incorporated can be used to present two traces simultaneously on screen. Thus input and output of an amplifier stage can be viewed at same time on screen. Distortion is indicated conclusively by difference between input and output traces, while fidelity is made evident by identical traces. Government instruction manual included **$39.95**

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(Sold at less than established factory price so we canot mention brand name)

Only $19.95 equipped with ¼" Jacobs Geared Chuck and Key. Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six shooter.
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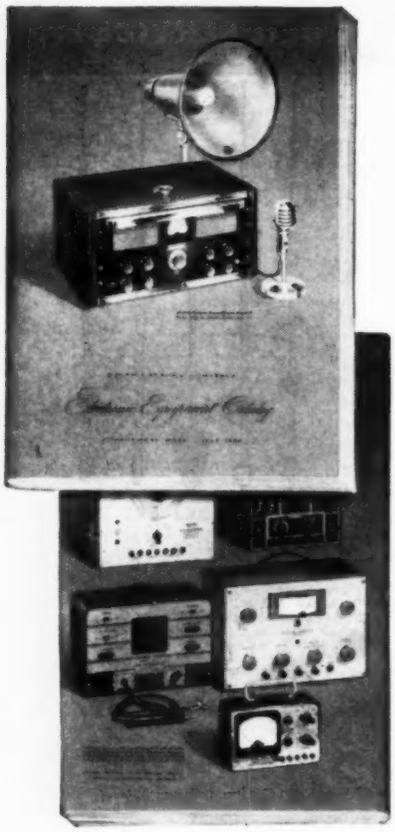
Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use.
25% deposit on C.O.D.'s. Full refund (you pay transportation) if not pleased with drill after trial.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 5N, BUFFALO 3, N. Y.
CABLE ADDRESS BUFRAD



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CAMERA CLUB Meets by Radio

By URBAN M. ALLEN

"The meeting will come to order" and a four-station ham net in the territory of Hawaii snaps into action.

DELEGATES from the four largest islands in the Hawaiian group had just wound up the convention at which the Camera Club Council of Hawaii had been organized, officers and directors from the four islands had been elected, when the problem of how to hold directors' meetings was raised.

The minimum air transportation cost to get the directors together for a meeting was more than $150.00 in addition to hotel accommodations, etc. This sum was more than the infant council's treasury could stand and more than the directors individually felt they could expend on their photographic hobby in addition to their budgets for film, paper, and gadgets.

It was suggested that directors' meetings be held by mail, but this suggestion was quickly voted down as being too time consuming. Secretary Alvin O. de Long then suggested that radio might be used to conduct the meetings. A commercial radiophone conference was found to be feasible but the cost was almost as high as that of getting the directors together in person.

Jack C. Wada, council treasurer and a ham, offered his station if the directors on the other islands could line up stations to complete the network.

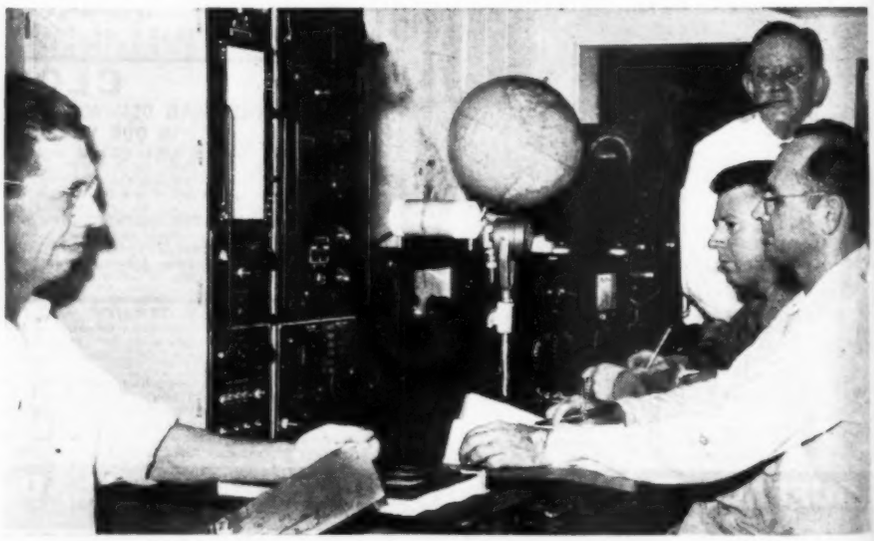
Secretary de Long, a radio expert with the CAA in Honolulu thought he would have no trouble in lining up a station in Honolulu and the senior directors on Maui and Hawaii, A. K. Jim and Millard Mundy, respectively, thought they could do the same on their islands.

It required only a little correspondence in the intervening six weeks to set up the circuit as follows: With Treasurer Wada's KH6LG for the Kauai or northernmost link, the chain was completed with KH6DA, owned by Lt. Comdr. H. E. Warren, 3992 Lurline Drive, Honolulu, a retired navy officer now connected with a Honolulu electrical firm; KH6FF, owned by David Kiyo Enomoto of Kahului, Maui; and KH6EJ, owned by William Seymour of Hilo, Hawaii, a veteran radioman who has set up most of the police radio stations in the territory.

Slightly more than a month after the initial conference the four radio stations were ready for a "dry run" to test equipment and see if the idea could be carried out. This test was a success and eight nights later, the directors and officers assembled in the four radio shacks for what is believed to have been the first over-water directors' meeting ever conducted by amateur radio.

In Jack Wada's shack on Kauai were Wada, and directors Pat Shannon and Kiyoshi Sasaki. In Comdr. Warren's station in Honolulu were Council Pres-

Key station of the four-island network is that of Lt. Comdr. H. E. Warren (ret.), KH6DA, in Honolulu. At left is Alvin O. de Long, council secretary and originator of the idea for the hookup. Standing in the rear is A. H. Tarleton, grand old man of photography in Hawaii and "chief kibitzer" of the council. Seated in the foreground is Urban M. Allen, council president, and behind him is Comdr. Warren.



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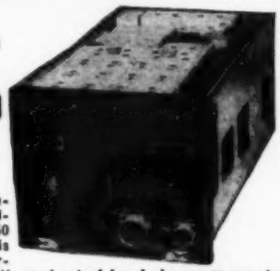
INCLUDING CASE

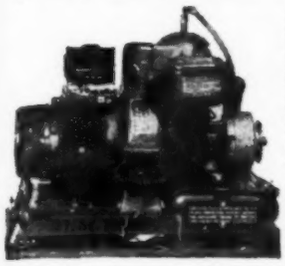
$19.50



Four bands, including broadcast (195-9,050 KC). Circuit is six-tube superheterodyne with mechanical band change or remote operated electrical band change. Remote band change and tuning controls included, making this set readily adaptable to mobile ham use. Powered from self-contained 24 V. DC dynamotor.

The sets are complete with tubes, mounting rack and remote controls.

(HRU) DC POWER SUPPLY



24-28 V. at 70 amp. 2000 watts gasoline engine generator with electric starter. Power supply which can be used to operate 24-28 V. equipment, start airplane engines, charge batteries, as a welding machine, lighting system, or for amateur radio station. 21½", 17½" x 24⅝". Wgt., 115 lbs. **$72.50**

Includes 20' plug-in cable.

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New 6 Volt battery in spill-proof clear plastic case, housed in metal case for easy mounting. Applicable for a wide range of uses where battery power is needed. Shipped dry. Uses standard battery electrolyte available everywhere.

Price, each	$4.00
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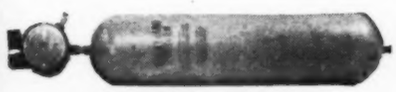

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TERMS: CASH WITH ORDER

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BRAND NEW SCR-625 MINE DETECTORS

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$79.50

SCR-274N COMMAND SET

SCR-274N Transmitter and Receiver Assembly consists of 13 pieces which are: 4 dynamotors, 1 modulator, 1 remote control box, 2 transmitters, 3 receivers and one antenna relay unit and it has its own individual dynamotor. Each receiver employs 12 V. tubes. Each transmitter contains four 12 V. tubes and has a variable frequency and crystal calibrated master oscillator, driving two 1625 final amplifier tubes, 55-watt output, with built-in silver plated variable inductance antenna matching device. Oscillator and final stage have simultaneous tuning and the dial is directly calibrated in MC. Transmitters have slugged and capacity tuning, built-in high voltage and antenna switches. Modulator furnishes plate supply for transmitters and is equipped with a dynamotor for high voltage. Also supplied is one antenna relay with built-in antenna meter. Transmitters make ideal VFO driver unit. Easily converted to 110 V. 60 cycle operation. Wt., approximately 100 lbs. PRICE..... **$24.75**

ANTENNA RELAY UNITS

Switching Relay—Current indicator BC-442. Consists of 50 MMFD vacuum condenser,—19.5 millivolt movement, current transformer and thermo couple. **$1.95**

(use with any rig).

★ ★

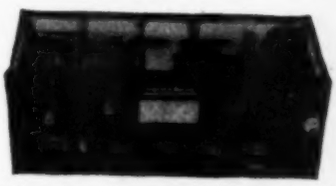
NOTE: ALL PRICES F.O.B. INDIANAPOLIS

R5/ARN-7 RECEIVER

ONLY **$19.95**

control heads available

Three bands 200 to 1750 KC. Complete with 17 tubes required. This set is ideal for conversion to home broadcast Receiver addition to ham shack, etc. Reported sold for many times the price when brand new. A Receiver that would be hard to pick up at this price.



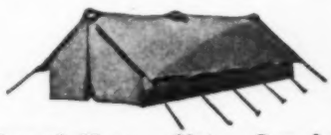
RADIO ALTIMETER APN/1

A complete 460 mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4-12SH7, 3-12SJ7, 2-6H6 1-VR150, 2-955, 2-9004. Other components such as relays, 24 V dynamotor, transformers, pots, condensors, etc., make this a buy on which you can not go wrong. Complete as shown in aluminum case 18"x 7"x7½". **$8.95**

INTERPHONE AMPLIFIER RL-9

Convert to high fidelity phone Amp. or speech Amp. Complete with tubes and dynamotor, for 24 V. DC operation. Used but in good condition.

SPECIAL PRICE **$1.95**



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New Navy Hospital Tents—fire resistant heavy canvas, 18' wide, 50' long, 12' at apex, 4' side walls—Complete except poles. Specially priced **$150.00**

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ATLAS SOUND

CORPORATION

1451—39th Street, Brooklyn 18, N. Y.

The Maui unit of the four-station chain is KH6FF, operated by David Enomoto (left). The Maui directors are A. K. Jim (right) and Harold Yamaguchi (center).

ident Urban M. Allen, Council Secretary de Long, and Salon Division Chairman A. H. Tarleton.

On Maui, in Kiyo Enomoto's shack were directors A. K. Jim and Harold Yamaguchi, and in Hilo, in Seymour's shack were directors Millard Mundy and Miss Mikie Kunieda.

Business was completed during the first session in 2½ hours (starting at 8:10 p.m.), requiring about 45 minutes longer than it would have taken if all the directors and officers had been in the same room but days faster than would have been possible by mail.

The plan worked so successfully that monthly directors' meetings were set up. Now, only two of the twelve directors' meetings each year will be held "in the flesh"—the rest will be by radiophone.

Among the decisions reached by the first directors' meeting were plans for holding Hawaii's first international photographic salon in conjunction with the annual meeting to be held on the island of Hawaii in July.

Information on this salon is available from A. H. Tarleton, Black & White Division Chairman, c/o Honolulu Paper Company, Ala Moana and South Street, Honolulu.

After the first successful meeting the directors agreed that radio was hard to beat as a medium for getting things done in a hurry and recommended it to other similar clubs.

For the benefit of anyone who may want to eavesdrop on a future council meeting, the sessions are held at 7:30 p.m. (Hawaiian time) the fourth Tuesday of each month. This would be 12:30 a.m., the fourth Wednesday, EST; 11:30 p.m., the fourth Tuesday, CST; 10:30 p.m. MST, or 9:30 p.m. PST. All four stations work on the 75-meter band.

According to the council's president after the first meeting "Two of America's greatest hobbies, photography and amateur radio, have joined forces in helping each other. Who knows, perhaps our radio friends will become infected with the shutterbug from their contact with us—and some of us may add radio to our hobbies."

-30-

The southernmost station in the network is that of William Seymour (right), Hilo's KH6EJ on the island of Hawaii. The Hawaii directors, Miss Mikie Kunieda and Millard Mundy meet in his shack each month for the camera-radio confab.

"TAB"

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1N23B X Diode, ea. $1.75	10 for	$15.00
RD/APN 4 Receiver LN*		39.95
GE RF MTR 1 or 5 Amp 2½" B'Csd	ea.	1.95
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W.E. 0 200 or 0 500VDC/1000 ohms V/3½"	ea.	4.95
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WESTON 4" Twin Galvo 10&40ma/.5%		12.95
DYNMTR 6Vin/out240V/100ma or 12&24Vin/500V/50ma; PM New Navy		3.49
DYN 28Vin/out540V/250ma USED LN*		2.50
DYN 12&24Vin/275V/110ma/P'MAGNET		1.95
DYNMTR 28Vin/out250V/60ma	2 for	1.98
DYN 12&24Vin/220V/100ma & 440V/200ma		5.95
DYN/24Vin/300V/260ma/150V 14.5V/3A		4.95
PE94A Same as above Plus Filters & Start		9.95
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VOLTAGE REGULATOR RAYTHEON New 95 130V/60cy Out 115V/60W		10.95
V'REGULATOR SAME 198 242Vinpt/50 60cy Outpt 220V/500/Watts/.5% Regltn		29.95
T17 MICROPHONE PUSH BUTTON & PLUG		.89

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245000**	250000	150000**	220000**
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ABOVE SIZES 20c. EA. ASSTD..... 10 FOR $.98

.116	89.8	580	2580	8500
.42	100	600	2600	9000
.5	105	612	2635	9445
.7	101	640	2700	9710
1.3	107	700	2860	10,000
1.75	113.1	733	2900	10,500
2	120	750	3000	12,000
3	121.2	800	3100	14,460*
4	125	900	3290	14,600
4.35	150	910	3384	15,000
5	160	1000	3500	15,000
5.025	165	1030	3730	17,000
6	170	1110	4000	17,000
7	182.4	1150	4300	18,000
7.5	200	1155	4440	19,000
7.8	209.4	1175	4444	20,000
7.9	230	1225	4500	20,520*
8	235	1250	4720	21,500
10	240	1260	4850	22,000
12	245.4	1322	4885	23,000
14.5	250	1350	4900	24,000
20	260	1500	5000	25,000
25	280	1510	5000	29,900
26	286	1600	5100	30,000
30	299	1640	5270	33,000
37	300	1650	5500	37,000
40	320	1800	5730	40,000
45	340	1830	6000	50,000
45.1	400	1865	6200	54,400*
49	418.8	1900	6300	60,000
50	426.9	2000	6500	65,000
55	440	2080	7000	68,000
56.7	452	2142	7500	75,000
60	480	2300	7700	80,000
71.4	487	2400	7950	84,000
75	500	2485	7950	90,000
80	520	2490	8000	91,000
81.4	540	2500	8250	95,000

ABOVE SIZES EACH 45c..... TEN FOR $3.00

0.1 MEG	.16675	.25 MEG	.4 MEG	.6 MEG
.1	.175	.254	.402	.62
.12	.185	.265	.422	.654
.13	.201	.268	.458	.7
.135	.22	.294	.478	.75
.14	.229	.314	.5	.7613
.14	.24	.33	.57	.8
.147	.245	.3335	.575	.9
.15	.25	.3535		.95

ABOVE SIZES EACH 60c..... TEN FOR $5.00

1 MEG	2	4	5	11.5
1.2	2.855	4.23	9.05	12.83
1.579	3	4.5	10	20
1.8	3.673			

ABOVE SIZES EACH 90c..... TEN FOR $6.95

VICTOREEN VACUUM PRECISION RESISTORS

.83MEG, 1MEG, 1.5MEG, 2MEG, 3MEG, 3.75MEG, ½ OF 1% ACCY HIVOLTS AT $1.00, TEN FOR $7.50
IRC NAVY PRECISION 1MG, ½ OF 1%..... 1.69
IRC NAVY WW 2MEG. 1/5 OF 1% HV..... 4.95

BLOWER Air 100CMF/115V AC		7.95
BOX Metal NAVY 5½ Hx10 Lx9¾"W/WHdls		1.45
Universal Tube to Voice Coil TRANSF		.98
GIBSON GIRL XMITTER ONLY NEW		$10.95
GIBSON GIRL SCR578, COMPLETE		19.95
BC1073 WVEMTR 150-210 mc's LN*		10.95
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COMPASS RCVR BC433/MN26 LN*		21.95
SAME Compass Revr LESS TUBES LN*		14.95
APS13/BCVR & XMITTER less tubes LN*		6.95
ARN 5/BC733 RCVR less tubes LN*		9.95
APN 1 ALTIMETER less tubes LN*		12.95
BC457/458 Like New*	ea.	5.95
BC456 MODULATOR less tubes LN*		1.69
BC212 TANK Intercom & tubes & Dyn	ea.	3.95
BC191/BC375 one TU & Tubes LN*		9.95
USN Flashlight perspective projector & ENLARGER 16 C 166 TM		5.95
FM TUNER & TEN TUBES Higain & pwr Supply 115V/60 Cy—Sens 5 microV		69.95
TBY VIBRAPACK & S'BATTERY		9.95
BOX KITE NYLON		2.49
BALLOON 4 ft. & Hydrogen gas Generator		4.50
GIBSON GIRL HAVERSACK waterproof		.98
STROBO FLASH AN/#1503/TWO LAMPS Inpt 12 V. Complete power supply, Cables & batteries & 2 KRYPTON Hi-Intensity lamps 12,000,000 lumens		98.50
STROBO FLASH #1503 CONVERTED to 115VAC & 3 KRYPTON lamps mtd in Reflectors & check bulbs		198.50
STROBOFLASH KRYPTON lamps & Ignitn Transf; 12,000,000 LUMENS/15 to 30,000 flashes sealed new	2 for	21.00
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COILS CW-3 5-10mcs		2.70
WILCOX RCVR CW3 & COILS NEW		16.95
AUTOSYN AY1&5/24-28V/60&400cy		3.95
AUTOSYN Type 5/50V/2 for 115V/60cy	ea.	4.95
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BENDIX GYRO SERVO NEW		2.95

Dual Crystal Tuning Unit BC746 & Handy Talkie-Coils & Crystals

CONTAINS TWO PLUGS IN CRYSTALS FT243/BT cut & Coils VARIABLE COND 140MMF XTAL SOCKET COMPLETE Includes Diagram

DATA DESIGN MINIATURE CRYSTAL CONTROL XMITTER AS PER QST TAB

SPECIAL, 98c	5 for	$3.49
COIL 5 Prong Slugtuned 2 to 2.7mc's	10 for	1.00
GE TELY 0.4MU'SEC PULSE TRANSF		1.49
LACING CORD #9 Per Pound		1.49
GE SAFETY SWITCH 69c	2 for	1.00

TRANSFORMERS 115V/60cy INPUT		
7500V or 15000V Doubles/35ma		15.95
10800 VCT or 21600V Doubler/95ma		19.95
3000V/10ma $4.50; 4000V/10ma		5.50
1320V/375VCT/110ma, 5V/3A, 2.5V/3.25A & 6.3V/2.75A Cased HV Insltd		7.95
1350VCT/150ma, 6.3V/5A, 5V/2A UTC		6.95
640VCT & 1250V/250ma $4.95	2 for	8.95
500VCT/60ma, 6.3V/4A Hmtclly Cased		1.29
1100VCT/212ma $5.95; 10V/8A/12KV		6.95
5V/115Amp $9.95; Input 165V output 2x330 CT		1.25
1000VCT/45ma; 795VCT/80ma; 3x5V/3A & 6.3VCT/TA, 6.3VCT/.3A 11V/Hmtclly Csd		4.95
7.5VCT/6.5A, 6.3VCT/3A		3.75
700VCT/150ma; 10V/3.25A, 2.5V/10A & 6.3VCT/2A, 5V/3A HV Insltd CASED		5.50
115 or 230V/10Amp/2KW Transformer		19.95
93, 103, 112, 117 or 230 V/1.6KW		14.95
115 or 230V/8Amp/1.8KW Auto Transf.		14.95
110 or 220 or 220 or 440V/190W		4.50
2.5V/1.75A, 4V/6A/20KV Cased		5.50
TRANSFORMER ONLY for Two 866A's		3.95
872A's COMBINATION TRANS sockets		12.00
872A TRANSFORMER 115 60cy		6.95
866A COMBINATION Tubes, sockets, Xformer		5.95
720/20ma, 5V/3A, 6.3V/3A CASED		2.95
220Vin/7.5V/24A/HV-CASED		5.95
220Vinpt, 10VCT/5A or 110Vinpt/5VCT/5A		2.95
576VCT/180ma, 5V/3A, 12V/4A CSD		3.95
510VCT/125ma, 5V/2A, 6V/4A CSD		3.25
TRIPLETT TUBE CHECKER TRANSF		2.95
220 to 440V-or-110 to 220V/250 Watt		4.95
AUTO TRANSF 6V/2A, 150V/1.6A, 35V/1.2A		3.95
SEL RECT TR/115/60c. 42.5V/2A		4.25

CHOKES

15-29Hy/150ma SWINGING CASED		2.95
12Hy/300ma $3.95; 3hy/40ma	3 for	1.00
15hy/400ma or 20hy/300ma/15KVins		7.95
3hy/400ma; 15KV $2.75; 8hy/200ma	2 for	2.89
8hy/150ma new UTC cracked bklte T'Bd	2 for	1.78
0.5hy/100ma/4 for 98c; 50hy/150ma		1.95
8hy/110ma $1.29; 12hy/275ma		3.29
TIME DELAY RELAY 115V/10Amp/ACDC		1.49
DECADE SWITCH 5 POINT	2 for	.98

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"TAB" MONEY BACK GUARANTEE. $5 MIN. ORDER F.O.B. N.Y.C. ADD SHIPPING CHARGES & 25% DEPOSIT.

XTAL-DIODES 1N21A, 22, 23A, 25, 26, 27 NEW boxed lead sealed G' insp @ $1	12 for	$10.00
IN34 X'DIODE @ $1.08; 2 for $2.10	10 for	9.85
HEINEMAN CKT BKRS 3, 5, 10, 15, 20, 25, 30, 35 @		1.25
Dual 10 Am $2.95; KLIXON 60 Amp		.89
SQUARE D 25 Amp Bkr & Toggle Switch		.69
VIBROPLEX KEY NEW Orig. Packing		5.75
EE65 TELEPHONE TEST SET		19.95
THERMISTOR WE/D163291/79c @	3 for	2.00
THERMSTR BEAD WE/D170396/79c @	3 for	2.00
MICROSWITCH 2 for 39c	10 for	1.49
MICROSWITCH SPDT 35c @	10 for	3.00
MICROSWITCH LEAF OR ROLLER	2 for	1.39
MICROSWITCH Plunger Type	2 for	1.39
CERAMICONS .001 or .001 mfd	12 for	1.00
CONDENSERS 2x.1/500V	2 for	1.25
.5mfd/1500V @ 75c; 1mfd/2000V	2 for	1.80
.03mfd/7500V $1.10; .05mfd/1500V	2 for	1.00
EE5 TELEPHONE AND RINGER	2 for	9.95
Pilot Light 1" & S6/115V bulb	2 for	.98
EDISON 35 Sec delay Relay 115V/10 Amp		1.49
GE Volt Control Relay PJV 115/60 cy		5.95

"TAB" FOR TUBES

OA4G	$ .90	25Z5	$ .70	8012	$3.95
OZ4	1.20	128K7	.88	8013	3.95
1B3/8016	2.00	35Z5	.61	8020	4.95
1E7G	.98	35L6	.74	9001	.49
1L4	.98	50L6	.72	9002	.39
1P5G	.79	80	.52	9003	.49
2C40	.73	83V	1.25	9004	.49
2D21	.98	OC3/VR105	.74	9006	.49
2X2	.49	OC3/VR150	.74	902A	2.85
2V3G	.98	211	.79	2AP1	1.95
3A4	.75	250TH	18.00	2A1A	4.95
3B7/1291	.95	250TL	18.00	3AP-	3.25
3D6/1299	.95	304TH	3.95	3BP1	1.98
3S4	.90	304TL	2.49	3DP1	2.75
5R4G	1.00	307A	3.75	3FP7	2.98
5T4	1.53	393	5.95	3GP1	3.95
5U4G	.69	446A	1.98	3JP13	3.95
5W4	.98	450TH	25.00	5AP1	2.75
5Y3G	.53	450TL	29.95	5BP1	3.75
5V4G	1.00	WL531	9.95	5BP4	3.75
5Z3	.80	703A	4.95	5CP1	3.75
5Z4	1.00	717A	.89	5FP7	3.95
6AB7	.98	723	2.95	5HP1	3.95
6AC7	.72	723AB	4.95	7PB7/1813	3.95
6AG5	.97	725	4.95	9JP1	3.95
6AG7	.98	803	7.95	12DP7	5.95
6AJ5	.98	804	8.95	1B24	2.95
6AK5	.81	805	4.95	1B27	2.95
6B4G	1.29	807	1.49	1P24	2.95
6B8G	.98	808	1.95	2P22	1.50
6C4	.39	810	5.75	10Y	.50
6C5	.75	811	2.49	15E	1.49
6C6	.73	813	8.90	2C26	.39
6C8G	.98	814	2.98	2C34/BK34	.49
6D4	.98	815	3.95	3B24	.74
6D6	.74	816	1.15	3C23	4.95
6E5	.98	826	1.45	24G/3C24	.67
6F6/1613	.69	828	10.00	2J21	12.75
6F8	1.20	829B/3E29	3.90	2J32	16.95
6G5/6H5	.98	832	2.25	2J55	18.00
6G6	1.08	836	1.10	2K29	4.95
6H6G	.48	837	2.25	VT127	2.95
6H6M	.68	845	4.95	HK24/3C24	.81
6J4	1.98	860	2.49	831P1/SN4	3.75
6J5	.72	861	9.00	CK1005	.30
6J6	.81	864	1.00	CJ6	4.95
6J7	.88	865	1.00	F127A	12.00
6K5G	1.10	868	1.00	T200	12.00
6K6GT	.74	872A	2.20	4J47	35.00
6K7	.78	884	1.10	RX215	9.95
6K8	1.20	922	1.49	CE215	5.95
6L6	1.24	923	1.39	CE206	2.95
6L7	1.16	931A	2.49	FG104	14.95
6N7	1.23	954	.49	FG105	16.95
6S7	1.20	955	.49	6D21	10.00
6SA7G	.98	956	.49	TUNGAR*	
6SC7	.84	957	.49	199698*	2.95
6SG7	.95	958A	.49	20X672*	2.95
6SH7	.38	1613	.69	289881*	2.50
6SJ7	.79	1614	1.50	MAZDA PL*	
6SL7	1.00	1616	2.75	44** Box	.40
6SN7	.91	1619	.39	47** Box	.50
6SN7GT	.69	1622	1.49	49** Box	.60
6SQ7	.89	1624	.79	S6* Box	1.40
6S87	.74	1625	.39	SOCKETS	
6V6GT	.98	1626	.45	Acorn...6 for	1.00
6X5	.67	1629	1.39	866	.24
6Y6G	.88	1635	1.90	Maginal	.49
12A6	.29	1641	.84	Diheptal	.69
12AH7	1.00	2050	1.18	2X2HV	.30
12SA7	.79	2051	.88	TUBES GTD	
12SH7	.68	8005	.49	except open Fil.	
			4.25	& Breakage	

CONDENSER OIL RATED WVDC CD		
TAPPED 2&.5&.3mfd/200V	15 for	$1.50
CD 2mfd/330VAC/1000WVDC	5 for	1.98
5mfd/600WVDC/220VAC & brackets	2 for	1.49
7mfd/600V 89c; 10mfd/600V		1.25
3.3mfd/225VAC $1.25; 4mfd/600V		.49
20mfd/600V/$2.50; 4mfd/330VAC/1000VDC		1.39
15mfd/330VAC/10000V/$3; 2mfd/2000V		2.25
3mfd/2000/ $3; 4mfd/3000V		5.00
2mfd/5000V $10; 4mfd/500V		15.00
2mfd/12500V $25; 1mfd/25000V		75.00
1mfd/4000V $3.75; .00025mfd/25KV		4.95
2x1mfd/440V 12 for $1; 3x. 1mfd/440V/10		1.00
1mfd/440V 12 for $1; 2mfd/400V	5 for	1.00
.5mfd/550V 10 for $1; 1mfd/500V	8 for	1.00
.05mfd/660V 30 for $1; 2x.05mfd/600V	25 for	1.00
3x.05mfd/600V 15 for $1; 3x.22mfd/600V	12 for	1.00
.1mfd/600V 10 for $1; 2x.1mfd/600V	6 for	1.00
3x.1mfd/600V 8 for $1; 2x.25mfd/600V	6 for	1.00
3x.25mfd/600V 5 for $1; .5mfd/600V	6 for	1.00
2x.5mfd/600V 6 for $1; 1.22mfd/600	8 for	1.00
.1mfd/1000V 4 for $1; .25mfd/100V	4 for	1.20
.2mfd/5000V $2.25; 1mfd/3600V		3.25

KIT SILVER & MICA COND8RS	50 for	$2.00
KIT SILVER MICA COND8RS	30 for	1.50
KIT CONTROLS 50—2 meg AB/POTS	10 for	2.00
KIT RESISTORS ½ & 1 W/50 to 2 meg.	100 for	2.50
KIT VITREOUS WW RESISTORS	20 for	1.00
KIT SOCKETS 25 ASSTD. (8-7-5-4P)		2.49
KIT POWER RHEOS. 25 & 50 Watt	6 for	3.49
KIT ROTARY SWITCHES ASSTD	6 for	1.75
KIT G&P Tube Caps ¼, ⅜, 9/16"	50 for	1.49
KIT COIL FORMS Thd'd small HF	50 for	1.00
KIT IRON CORE SLUG & SCREW	50 for	1.00
KIT ELASTIC STOP NUTS ASST	50 for	1.00
KIT LUGS LARGE RADIO Elec Type	100 for	1.00
KIT LUGS SMALL RADIO TYPE	300 for	1.00
KIT KNOBS ASSTD with Insert	25 for	1.25
KIT MOTOR BRUSHES ASSTD	100 for	1.00
KIT SPAGHETTI Sleeving ASSTD	75 for	1.00
KIT CERAMICON COND8RS ASSTD	15 for	1.00
KIT FUSES ASSTD BUSS & LF	300 for	1.95
KIT GROMMET Rubber Radio Asst	100 for	1.00
EXT CORD Hvy Duty 8J/16' M&F plugs		.98
COAX CNNCTRS PL259 or S0239 ea. 35c, PR		.63
SWITCH SPDT 15000V/5 Amp/1821		2.95

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THAT'S A BUY • • • CORNER CHURCH & LIBERTY STS., ROOM 200 • • • THAT'S A BUY

HEATHKIT SERVICE INSTRUMENTS

BUILD • • • LEARN • • • SAVE

Ideal for Schools, Training Courses, Laboratories—Service Shops, Hobbyists.

HEATHKIT

SIGNAL GENERATOR KIT

$19.50

NOTHING ELSE TO BUY

Every shop needs a good signal generator. The Heathkit fulfils every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110 V 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Weight 4½ pounds.

HEATHKIT SINE AND SQUARE WAVE

AUDIO GENERATOR KIT

$34.50

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The ideal instrument for checking audio amplifiers, television response, distortion, etc. Supplies excellent sine wave 20 cycles to 20,000 cycles and in addition supplies square wave over same range. Extremely low distortion, less than 1%, large calibrated dial, beautiful 2 color panel, 1% precision calibrating resistors, 110 V 60 cycle power transformer, 5 tubes, detailed blueprints and instructions. R.C. type circuit with excellent stability. Shipping weight 15 pounds.

HEATHKIT SIGNAL TRACER KIT

$19.50

NOTHING ELSE TO BUY

Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110 V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions.

Small portable 9" x 6" x 4¾". Wt. 6 pounds. Ideal for taking on service calls. Complete your service shop with this instrument.

HEATHKIT HIGH FIDELITY

AMPLIFIER KIT

$14.95

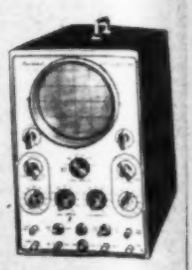
NOTHING ELSE TO BUY

Build this high fidelity amplifier and save two-thirds of the cost. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SN7), and a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8-15 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

12" PM speakers for above.....$6.95

NEW 1948 HEATHKIT 5 INCH

OSCILLOSCOPE KIT



$39.50

NOTHING ELSE TO BUY

A necessity for the newer servicing technique in FM and television at a price you can afford. The Heathkit is complete, beautiful two color panel, all metal parts punched, formed, and plated and every part supplied. A pleasant evening's work and you have the most interesting piece of laboratory equipment available.

Check the features—large 5" 5BP1 tube, compensated vertical and horizontal amplifiers using 6SJ7's, 15 volts to 30 M cycle sweep generator using 884 gas triode, 110 V 60 cycle power transformer gives 1100 volts negative and 350 volts positive.

Convenient size 8½" x 13" high 17" deep, weight only 26 pounds.

All controls on front panel with test voltage and ext. syn post. Complete with all tubes and detailed instructions. Shipping weight 35 lbs.

Order today while surplus tubes make the price possible.

The NEW

HEATHKIT VACUUM TUBE

VOLTMETER KIT

$24.50

NOTHING ELSE TO BUY

The most essential tool a radio man can have, now within the reach of his pocketbook. The Heathkit VTVM is equal in quality to instruments selling for $75.00 or more. Features 500 microamp meter, transformer power supply, 1% glass enclosed divider resistors, ceramic selector switches, 11 megohms input resistance, linear AC and DC scale, electronic AC reading RMS. Circuit uses 6SN7 in balanced bridge circuit, a 6H6 as AC rectifier and 6X5 as transformer power supply rectifier. Included is means of calibrating without standards. Average assembly time less than four pleasant hours, and you have the most useful test instrument you will ever own. Ranges 0-3, 30, 100, 300, 1000 volts AC or DC. Ohmmeter has ranges of scale times 1, 100, 1000, 10M and 1 megohm, giving range .1 ohm to 1000 megohms. Complete with detailed instructions. Add postage for 8 lbs.

HEATHKIT

CONDENSER CHECKER KIT

$19.50

NOTHING ELSE TO BUY

A condenser checker anyone can afford to own. Measures capacity and leakage from .00001 to 100 MFD on calibrated scales with test voltage up to 500 volts. No need for tables or multipliers. Reads resistance 500 ohms to 2 megohms. 110V 60 cycle transformer operated complete with rectifier and magic eye indicator tubes.

Easy quick assembly with clear detailed blueprints and instructions. Small convenient size 9" x 6" x 4¾". Weight 4 pounds. This is one of the handiest instruments in any service shop.

A WORD ABOUT HEATHKIT INSTRUMENTS

All Heathkit service instruments are supplied complete in every way—grey crackle cabinets, 2 color calibrated panels, all tubes, test leads (where required) etc. All are 110 V transformer operated. Calibrations are complete and exact, 1% precision resistors are supplied where needed.

Heath engineers are ready to assist and advise.

Heathkits are sold direct to customer, order from this ad. All are guaranteed.

The HEATH COMPANY

BENTON HARBOR, MICHIGAN

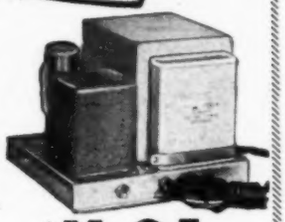
COMMAND SET ACCESSORIES

BEST of SURPLUS

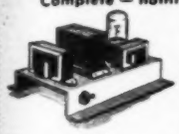
TRANSMITTER POWER SUPPLY KIT

For BC645, 223, 522, 274N's, etc. Ideal for powering military transmitters. Supplies 500 to 600 volts at 150 to 200 MA plate, 6.3 at 3.6A, also 9V and 12V A.C. Kit supplied complete with husky cased Acme 110V 60 cycle power transformer, 5U4 rectifier. Sprague oil filled condenser, cased choke, punched chassis, and all other parts, including detailed instructions.

Complete — nothing else to buy



$11.95



110V RECEIVER POWER SUPPLY KIT

With 24 volt filament, no wiring changes inside set, punched chassis and volume control **$5.95**

5" PM SPEAKER

With output transformer, matching headphone output **$2.80**

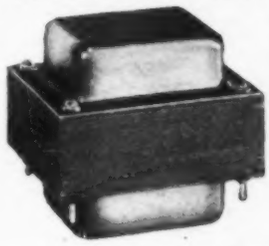
Dual receiver rack FT277A with connecting plugs **$1.00**

Single transmitter rack FT234A **$1.00**

MILITARY CONVERSION POWER TRANSFORMERS

Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V at 2A and 24V at ½A. "B" type supplies 500 VCT at 50 MA, 5V at 2A and 12V at 1 amp. State whether A or B type desired..... **$2.95**

POWER TRANSFORMER *Specials*



A wonderful buy in a new production heavy duty power transformer. Primary 117V 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V at 4 A. An ideal transformer for high quality amplifier modulator, small transmitter or quality radio. Will handle 13 tube radio receivers. Supply is limited, order early.

$3.95 . . . 3 FOR $9.95

INPUT AND OUTPUT TRANSFORMER

Two units in one case carbon microphone input and output from 155 to 150 ohm load used in Handie Talkie No. 744 special 4 for..... **$1.00**

Filter Choke 15 henries at 60 MA cased type hermetically sealed No. 643, each... **$1.00**

OUTPUT TRANSFORMER

Push pull 6V6's to 6-8 ohm voice coil excellent characteristics No. 800. 3 for... **$1.95**

OUTPUT TRANSFORMER

Couples, 6C4, 6J5, etc. to 500 or 5,000 ohm line No. 716. 2 for **$1.00**

MIDGET AMATEUR TRANSMITTER KIT

Complete kit to assemble a 1 Watt battery operated amateur 80 meter transmitter, including tube and crystal. Range up to 500 miles. Only accessories needed are sending key and batteries. Complete instructions supplied. Add postage for 2 lbs.

ACCESSORIES

Key (add postage for 2 lbs.)..... $1.00
Kit of batteries (add postage for 4 lbs.) 3.25

$3.95

AN/APN1 RADIO ALTIMETERS

Brand new, complete with tubes, dynamotor, antennae, indicator, switch, plugs and instruction manual. Consists of 420 MC transmitter and receiver. Converts into excellent beat radar indicating in feet, or amateur 420 MC rig. In original crate.

$34.95

T32 TABLE MICROPHONE

One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons, add postage for 5 lbs..... **$2.95**

SOCKET SPECIALS

Single hole mounting octal, brown, low loss, bakelite, less locking rings, 25 FOR..... **$1.00**

2 hole flange mounting octal bakelite 1-5/16" mounting centers. 20 FOR..... **$1.00**

Ceramic 2 hole flange mounting octals, 1½" mounting 10 FOR..... **$1.00**

Ceramic acorn sockets 5 FOR..... **$1.00**

SOCKET KIT

20 beautiful octal, loctal and miniature sockets. **20 FOR $1**

HEARING AID HEADPHONES

The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete. Add postage for 1 lb.

$1.00

DYNAMOTORS

Consists of electric motor operating generator on same shaft. Many applications — operating radios from storage battery - using as motor.

Dynamotor C — Input 28 volts, output 220 volts at 60 MA. Shipping Weight 6 pounds. **$1.50**

Dynamotor A — Input 12 volts, output 1000 volts at 350 MA. Shipping Weight 72 pounds. **$5.95**

Dynamotor B — Input 6 or 12 volts, output 500 volts, 160 MA. Shipping Weight 30 pounds. **$5.95**

G. E. MODEL BC-375 TUNING UNITS

$2.49

These General Electric 150 Watt transmitter tuning units are the greatest surplus buy. Over $30.00 worth of new condensers, coils, switches. National Velvet vernier dial, etc. Supplied complete with cabinet and two reprints of conversion articles for transmitter and receiver reprinted from RADIO NEWS. Specify TU5B, TU10B or TU26B. Add postage for 20 lbs.

HEATHKIT 3-TUBE ALL-WAVE RADIO

110-volt AC operation

An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker. Battery model for use where no AC house current is available. Add postage for 3 lbs.

$5.95

Heathkit Beginners' Radio 110-volt type..... $5.95
Heathkit Beginners' Radio, battery type (2 tubes, no rectifiers)..... $5.95
Headphones for either type HS 30 per set..... $1.00
2½" permanent magnet loudspeaker for either type $1.95
Batteries, complete kit for battery type set.... $3.25

INTERPHONE 2-WAY CALL SYSTEM KIT

Ideal call and communication system for homes, offices, factories, stores, etc. Makes excellent electronic baby watcher, easy to assemble with every part supplied including simple instructions. Distance up to 1/5 mile. Operates from 110 V.A.C. 3 tubes, one master and one remote speaker. Shipping Weight 5 pounds.

$14.50

The HEATH COMPANY

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LETTERS from our readers

INTERFERENCE

"I AM quite interested in the problem discussed by Jack Watt of Ontonagon, Michigan in the February issue of RADIO NEWS. He points out the chaotic situation at night on the broadcast band in all but the metropolitan areas of the country.

"It seems that the FCC is extremely slow in realizing that the broadcast band should be utilized to the best advantage for entertainment of the people and not primarily for the profit of the owners of the stations. Occasionally the FCC gives signs, by concrete action such as the frequency shift and clear channel assignments, that the policy of the Commission calls for best coverage for the entire country. However, since the war, with the addition of so many new stations and the power increases, the situation has grown rapidly worse. The FCC completed, about November 1, 1947, a hearing on the general broadcast band problem which it began in May, 1945.

"Out of the mass of evidence presented have come two general proposals. Oversimplified they seem to be: (1) That the FCC reduce the number of 1-A stations and allow more local stations and more power to bring reliable groundwave signals and local programs to rural areas. (2) That the U. S. be divided into five parts with four high-power, clear channel stations of at least 750 kw. each (more later). In general, these four stations covering one area should each carry different network programs to make the widest choice of entertainment available. Small stations would receive an increase in daytime power.

"To even the occasional listener, proposal (1) seems a big step in the wrong direction. Regardless of power, reception is disgusting when interfering signals are present. It is generally recognized that increasing power increases areas of interference between stations on the same frequency. As would be expected this plan is pushed by the regional broadcaster, that is, the small station group.

"The second plan seems the best so far proposed. All who remember back to the days when WLW had a half-million watts recall the excellent night-time reception provided for most of the country. The regional group contend that this proposal will make it impossible for some states to have any fulltime stations with more than 5 kw. of power and thus the distribution would not be equitable. Wouldn't most listeners prefer good reception from neighboring states to poor reception from their own? The networks, of course, oppose the plan because it would mean a reshuffling of the network affiliations. It seems surprising that such objections should stand in the way of a choice of programs being made available to all.

"It is believed by many qualified engineers that daytime reception can be greatly improved by increasing daytime power of many stations and by limiting many old stations and all new ones to daytime only.

William L. Brown
Instructor, Electrical Eng.
Mississippi State College
State College, Mississippi

* * *

"I FEEL exactly as Reader Watt does about the mess that the FCC has allowed to come upon the rural radio listeners of America by permitting an exorbitant increase in the number of broadcast stations without seemingly making any effort to determine the amount of interference it would cause.

"I am a radio serviceman and I hear plenty of indignant remarks from customers about the cluttered up mess of stations that are on the air, especially at night. If you want to hear a prize fight or other program that doesn't happen to be on a strong, clear channel station, well you just can't hear it.

"Unless the FCC changes its course of action and rectifies its mistakes in this unlimited granting of broadcast permits, the radio manufacturing industry as well as the serviceman is going to suffer because there is a time coming soon when the buying public will refuse to spend money on broadcast receivers when they get such a small amount of satisfaction from them.

"I think it is high time that radio listeners, servicemen, and all other interested parties begin flooding the FCC with protests about the present setup and demand remedial action."

Lloyd Butler
Shoals, Indiana

* * *

"I WANT to add my word of protest against indiscriminate licensing of radio stations in the United States as told by Mr. Watt in the February issue.

"May I point out one error, typographical, I presume, in his letter? The

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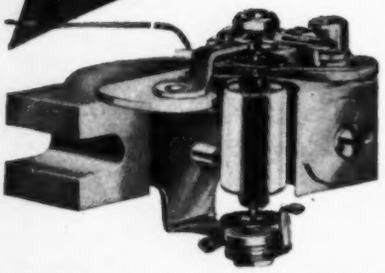

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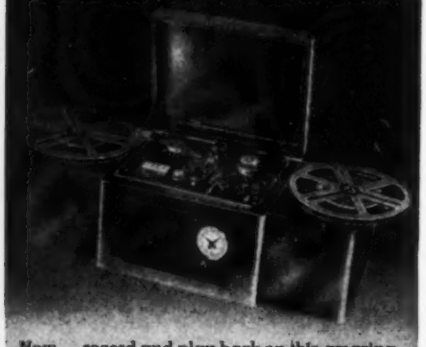

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count of US radio stations has now reached the staggering total of 1824 stations between 500 and 1600 kc., not 800 as the printed letter states. Couple this total with the superpowered Mexican illegal border stations (being run by people who can't get licensed in the United States) and the many Cuban transmitters and you really have an astonishing figure.

"Within the past few years, even great stations like WBBM, WCBS, and W2XR have lost their clear channel daytime status due to the friendly feeling the FCC seems to have for any local merchant with enough money to erect a transmitter and purchase a few hundred cheap records. The remaining clear channel stations, like WLW in Mr. Watt's letter, must surely have a powerful lobby somewhere.

This situation is becoming intolerable. Instead of more radio (AM) service, the FCC is defeating its own ends. Let there be a stop to this feverish licensing and the transfer of all these local potboilers with their Sinatra records to one section of the dial where they can annoy no one except themselves."

John D. Sadlier
Springfield, Ohio

* * *

"JACK Watt expressed my sentiments in the February issue of RADIO NEWS exactly.

"May I add this. Today, a cold overcast Sunday afternoon, no static, and low noise level I checked on a 19 tube *Silver* receiver each channel of the broadcast band, starting about 4:30 p.m. and found the following:

"Channels hopelessly garbled—41.

"Channels with strong signal clear enough for voice reception, that is, the farmer could get the weather report, but no good for continued listening to any type of program because of background speech or music on carrier beats —43.

"Clear, noise free channels held that way by strong local stations (except late at night)—3.

"Clear, noise free channels held by distant stations where reception was good except for fading—2.

"Channels with signal below noise level or no signal—3.

"One channel featured a 1000 cycle test note and one or two had weak signals, etc."

Byron E. Dickensheets
Milton, West Virginia

* * *

That the problem of interference is not a local matter has been clearly indicated by the letters which have been received from all parts of the country. Thanks to all of the readers who took the time to write their experiences and suggested solutions. Space doesn't permit us to print all of the comments we received. —30—

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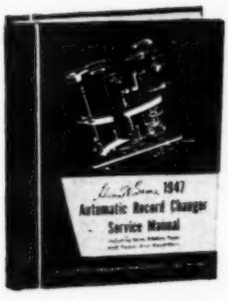

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- ☐ Send.....SAMS' TUBE PLACEMENT GUIDE(S) AT $1.25 per copy.
- ☐ Send.....SAM'S 1947 AUTOMATIC RECORD CHANGER MANUAL(S) at $4.95 each.
- ☐ Send.....SAMS' DIAL CORD STRINGING GUIDE(S) at $1.00 per copy.

Name.....

Address.....

City.....*State*.....

HOWARD W. **SAMS** & CO., INC.
INDIANAPOLIS 7, INDIANA

Export—Ad. Auriema—89 Broad St., New York 4, N. Y.—U. S. of America
Canada—A. C. Simmonds & Sons, 301 King St., East—Toronto, Ontario

PHOTOFACT SERVICE

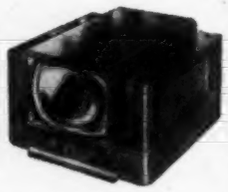
"The Service that pays for itself over and over again"

In New Jersey...

...it's **VARIETY**

TELEVISION KITS

TRANSVISION STANDARD MODEL 12" KIT



Picture size 75 square inches. 22 tubes and 12 inch picture tube. High fidelity FM sound reproduction. Advanced television circuit provides exceptionally clear pictures. The Aristocrat Special (illustrated above), Model 10BL, 130 sq. in. picture.
List $389.00*

The Magnifier Model 7BL 52 sq. in. picture-Cabinet and Lens inclusive. List $219.00—dealers price **$189.00** net

Magnifier Cabinet. For 7" Kit with Lens....list $ 44.95*
The Aristocrat Model 10BL, 110 sq. in. picture. Cabinet and Lens, inc.....list $359.00*
The Aristocrat Cabinet with Lens suitable for 10" or 12" receiver.....list $ 99.00*
12" Standard Television Kit.....$289.00*
12" Deluxe Television—FM Radio Kit.....359.50*
15" Standard.....365.00*
15" With FM Radio.....372.95*
7" Television Kit.....169.00*
(Complete with tubes, less cabinet)
Cabinet for 12" Television, Receiver.....44.95*
Cabinet for 15" Television Receiver.....59.00*
Espey Basic Television Kit, less tubes.....69.50
Complete Line of Television Components.
*Dealers' Price on Request.

REPUBLIC TELEVISION KITS

7" kit .....$165.00 10" kit 199.50
7" kit conversion to 10", includes all parts, tube, instructions 75.00

SPECIAL

VARELCO 300 ohm television.....$2.70 per 100 ft.
twin lead wire .....20.00 per 1000 ft.
NATIONAL NC-33 RECEIVER AC-DC 4 band superhet.....$65.95
We carry a full line of National receivers and parts.
National NC183 Receiver complete with 10" speaker $269.00

SUPREME MODEL 584 SUPER SENSITIVE MULTI-METER

D.C. VOLTS 25-5000, 20,000 Ohms per V. A.C. VOLTS 100-5,000, 1000 ohms per V. Resistance Ranges 0-20 megs. D B & Output ranges. Net **$33.77**

VARIETY RADIO KITS

Pictured: 2-tube, electric kit, complete with tubes and all parts but solder and hookup wire.
RT2 .....$7.95 net
One-tube kit, RT-1 .....$5.95 net
Three tubes and selenium rectifier kit, RT4 including speaker and tubes, complete with cabinet, less hookup wire and solder $12.95
RT5—Five tube super-het, less cabinet.....$15.95
VA3—Five tube special super-het kit, complete with tubes, cabinet, etc. $14.75
Phono Oscillator, 2 tube kit $4.20
3-Tube amplifier kit $6.25

***NEW!* PREMIER Model 570 MICROMASTER Band Spread Dial SIGNAL GENERATOR**

For testing and aligning BROADCAST, SHORTWAVE, FM and TELEVISION RECEIVERS. Exclusive Band Spread Dial geared to the tuning condenser and main dial, giving a total scale length of approximately 60 inches. Three-color dial directly calibrated in Kilocycles and Megacycles. Range: 75 KC—50MC. Up to 150MC on 3rd harmonic. Size 12½"x12"x5½".

COMPLETE WITH TUBES AND CO-AXIAL CABLE. **$54.75** Net

Write Dept. RNS. 20% Deposit with order required. Please add sufficient postage. Excess will be refunded.

Variety **ELECTRIC CO., Inc.**
601 Broad St., Newark 2, N. J.

Novel Servicing Idea Proves Profitable

By R. C. TRAVERS

There is good profit to be made from radios that travel aloft. Here's how one alert group does it.

THE Aurora Sales and Service of Aurora, Colorado (a suburb of Denver) believes that alert and enterprising radiomen can subsist nicely on the business derived from airport radio servicing.

The company has concluded agreements with a number of regional air lines (Monarch and Challenger) which operate in Utah, Colorado, and Wyoming. Under terms of the agreement hostesses or ticket clerks hand out cards to all arriving or departing travelers, suggesting that the passenger have his or her portable checked at the radio service station while shopping or doing business in Denver. Radios may be left at the airport ticket office, the patron is given a receipt, and then the set may be picked up at the close of the day--completely checked. Radios are picked up from the local airport ticket office every few hours and taken to the service shop.

Pilots, ticket sellers, and officials of all regional air lines are issued certificates entitling them to have their radio service work done at a ten per-cent discount. In addition, the company furnishes all airliners with three or four reconditioned portable radios which may be rented to passengers for their use during the flight. Rental fees on this item are split between the air line and the radio service organization.

Each airplane operated by these regional groups are provided with a conventional recorder which passengers may rent for a nominal fee. When passengers depart they can take the waxings with them. These records may range from important business communications to a record for the family. Fees for this service are split on a 50-50 basis by the air line and the service shop.

Aurora Sales and Service has inaugurated several other interesting promotions. Patrons of the radio shop living in small communities served by the air line can have their aching radios picked up at their homes and transported to the airport. From there they are flown to the Denver airport where the company picks them up, services them, and returns them via air. This service has proven popular with restaurant or nightclub operators who have a "sick" p.a. system which needs a quick repair job. The regional air lines give such radios a special air freight rate and on all repairs over $15.00 Aurora Sales pays one-third the air freight rate. Newspaper advertisements offering this service are run in weeklies and dailies in more than sixteen communities with air line transportation facilities to Denver.

Aurora Sales is especially interested in the several aviation parks where students are taught to fly. It has an arrangement with four flying schools to check over all radio installations daily at a special weekly rate. This check up takes only fifteen minutes per radio and a $10.00 weekly charge covers this service on a seven day basis. (Sunday is a busy day for aviation schools.)

The company also places coin-operated radios in the waiting rooms of the regional air lines where passengers may enjoy fifteen minutes of selected radio entertainment for a dime. The patrons are offered a choice of four local stations.

This alert organization goes even farther afield to garner business. As a sideline it makes sound motion pictures of the local aviation training programs. These films are used by the aviation schools as an aid to selling their courses to likely prospects. These aviation "soundies" last fifteen minutes and show students being put through the lesson paces.

They have also entered into an agreement with airplane sales agencies whereby each purchaser of an aircraft receives a voucher good for six yearly inspections of the plane's radio installation at a fee of $25.00 per year. Letters are sent periodically to all owners of aircraft pointing out that in order to keep their insurance in force they must have their radio equipment in A-1 working condition at all times.

Aurora's service charge for private aircraft radios is $2.50 per service hour for the first hour and $2.25 per hour thereafter. A 30-day guarantee is given owners of the private aircraft radio equipment.

The company has also arranged a tieup with national air lines, such as United, Continental and Braniff, to check radio equipment on the short hauls operated by those companies. This checkup takes only ten minutes daily and covers every plane landing at the Denver airport. Aurora technicians meet all main line planes flying the coast-to-coast runs, check with the radio operator who reports any specific difficulties --otherwise a routine check is made. These checkups lessen the chances of radio failures aloft. According to Aurora, air line radio servicing is both profitable and pleasurable.

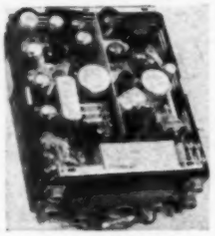
Finally, the company has contracts with a number of municipalities within a 75 to 200 mile radius whereby, for a yearly stipend of $200.00, airport beacon and tower radio systems are inspected weekly during the year. Many smaller communities are happy to include this small amount in their yearly airport maintenance budget as it minimizes chances of crashes within the vicinity of the airport.

All in all, Aurora Sales and Service is making a big thing of airborne radio, whether it flies as a part of the plane equipment or as a portable clutched in the hand of a passenger. —30—

STAHL'S ★ Star ★ Studded ★ Specials!!

BC-645A 450MC X-Mitter-Receiver

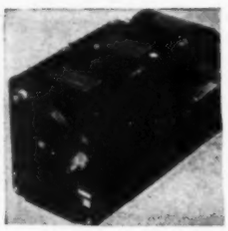
BRAND NEW



Complete with Tubes includes 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and 1-WE 316A door knob. Can be easily converted for Phone or CW on 420-450Mc Bands..... **$7.95 each**

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

6 TUBE BRAND NEW Receiver with tubes

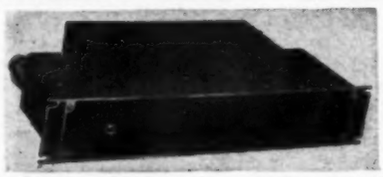


Receivers of the SCR-274-N/(AN/ARC-5) Series. All-aluminum aircraft receivers 5" wide, 8" high, 12½" long; weight 6½ lbs. Typical tube line-up is: 12SK7 RF, 12K8 Converter, two 12SK7IF's, 12SR7 Detector and BFO, 12A6 Output, gas-filled antenna-signal voltage limiter, and gas-filled output signal voltage limiter. Each set comes complete with all tubes in sockets.

Item 1:	3 to 6 Meg. less dynamotor	$5.95
Item 2:	1.5 to 3 Meg. less dynamotor	$6.95
Item 3:	Dynamotor for above	$1.95

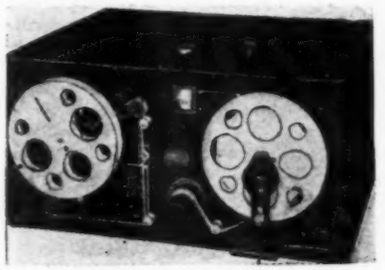
★★★★★★★★★★★★★★★★★★★★★★★★★★★★

WILCOX CW 3 7 Tube Receiver **Complete with Coils** **$12.95**



Complete with 1 set of coils—5.1 mc. to 10 mc. & Additional set of tubes. Brand new in original cases. Export packed. Highly selective Superhet. 5,100 to 10,000 KC range. The h-f oscillator is xtal controlled. 110V. AC, 60 cycles 2-6K7; 1-6K8; 2-6C8G, 1-7SN7; 1-80. Single stage r-f amplifier single stage i-f, second detector, b.f.o., audio output and output limiter stage and a rectifier. less crystal. While they last at this low price of $12.95

★★★★★★★★★★★★★★★★★★★★★★★★★★★★



CODE KEYER TG—10

An automatic unit for code practice signals, from an inked type recording. It's a self contained unit, complete with 7 tubes and electric eye tube; operates on 110-120 volts AC, 60 cycles. Size 11x24x18½ inches. Weight approximately 63 lbs. Audio frequency output of 800 cycles per second. Power unit can be converted to P.A. system. Also a 78 RPM, 110 volt AC motor, can be used for turntable. Complete, only... **$19.50**

METERS

2" Round **Westinghouse** Bakelite Case 0-30 Milliamps. D.C. $2.25

2" Round **Triplitt** Bakelite Case 0-35 Mill D.C. in Black Wrinkle Finish. Round Metal Box.. 2.25

2" Round **Westinghouse** Bakelite Case 0-100 Mill D.C. 2.50

2" **Westinghouse** 0-150V A.C. Bakelite Case.. 3.00

3" Square **General Electric** Bakelite Case 0-15 Mill D.C. 3.45

3" Round **General Electric** Bakelite Case 0-500 Mill D.C. 3.45

3" Round **Beede** 0-1000 Mill D.C. Bakelite Case 1.95

3" Round **Western Electric** 0-1000 Mill D.C. Bakelite Case 2.25

3" Round **Westinghouse** 0-15 Mill. D.C. Bakelite Case 3.45

3" Square **G.E. Type. D. O.** 500 Microamperes with odd scale, Bakelite Case 3.45

3" Round **Westinghouse** Bakelite Case 0-1 Mill. D.C. with bad & good colored scale can be used in tube checker 3.45

3" Square Bakelite Case **Westinghouse** 7.5 Volt A.C. 3.45

3" Round **Western Electric** Bakelite Case 100-0-100 Milliamps. D.C. 3.45

3" Round **Burlington** Bakelite Case 0-75 Amperes A.C. 3.45

3" Round **Triplitt** Bakelite Case 0-150 Volts A.C. 3.45

3" Round **General Electric** Bakelite Case 0-30 Mill. 3.45

3" Square **Triplitt** Model 327A Bakelite Case 0-200 Milliamps. D.C. 3.45

3" **Triplitt** Model 321 Bakelite Case 0-300 Milliamps 3.45

4½" **Weston** Panel Board flush metal case 0-5 amp. A.C. with a 0-200 amp. scale 3.95

Weston Model 506; 1.5 Mill. D.C. Metal Case.. 2.25

Weston Model 506; 15 Mill. D.C. Metal Case ..2.25

Weston Model 507 Metal Case 1.2 Mill. 0-100 Scale 1.95

Roller Smith portable lab 0 to 150 Mil. D.C. Bakelite Case with handle; 5½ x 6 x 3½ 19.50

Roller Smith portable lab 0 to 15V D.C. Bakelite Case with handle; 5½ x 6 x 3½ 19.50

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

CONDENSERS

G. E.	.35 Mfd.	5000V	$1.50
Aerovox	10 "	600V	.95
G. E.	4 "	1500V	1.50
G. E.	1 "	2000V	.95
G. E.	4 "	600V	.50
C. D.	2 "	2000V	1.95
C. D.	2 "	1000V	.95
Sprague	1 "	3600V	.95

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

1N21 & 1N23 Western Electric Crystals... 35c each 3 for $1.00

Hipower quartz. Crystal units, type CF5, 5000 KC, complete with holder $1.95

Jefferson step down (or step up) power circuit transformer double wound 230V input 50 - 60 cycle, to 115V output, 250KVA. Weight 17 lbs. $7.95

Standard rack cabinets heavy gauge steel, gray crackle finish; panel opening 19" wide. 27" high $2.95

Parallel No. 18 Zip wire; 10 feet lengths, with lugs on each end. Each ..... .10

Hammerlund variable APC210 micro microfarad .50

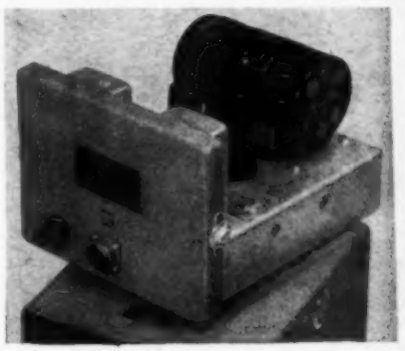
★★★★★★★★★★★★★★★★★★★★★★★★★★★★

RCA-CRV-51019 Hand Sets self contained battery operated. Uses 4 pen light batteries excellent for Television Antenna installation. Sold in pairs only ..... Pair 15.00

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

Blank Calibration Books for BC 221-Frequency from 125KC to 20000KC printed in .10 divisions —68 pages, aluminum cover, spiral bound... $1.50

Interphone Amplifier Brand New



Beautifully constructed, in grey finish sturdy metal cabinet. Operates on 24 volt input, complete with dynamotor. Has 1-6V6 and 1-6SJ7 tube, volume control, carbon or magnetic microphone input. Fastened to sturdy resilient mounting on rubber. The case is worth the price. Only **$3.45**

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

Navy Standard Battery (Brand New)

Made by Gould Storage Battery Corp. 6 volt 15 amp hour. Excellent for amateurs, experimenters, radio servicemen, &c. Shipped dry, with complete instructions for charging. 4¾x4¾x6¾ high. Shipping weight 12 lbs. While they last **$4.95**

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

5 Inch Cathode Ray Type 5 BP1 tubes. In their original cartons; Brand New. At this price every scope owner should buy a few, and keep in reserve. How can you go wrong for only $4.95

SCOPE Tubes—2"—2AP1 ..... **$1.95**

★★★★★★★★★★★★★★★★★★★★★★★★★★★★

RAYTHEON RECTICHARGER W-3155

$49.50

Supply Current at a constant voltage and supplies current to a storage battery, providing an automatic AC - DC power system. Has no moving or expendable parts — therefore no frequent adjustment or maintenance is necessary. The life of the battery increases as much as 40%. Eliminates voltage variations.

Range of unit 11/12 cells, 22 to 24 volts @ 3 amp. output. Input supply source 95 to 130 volts, 60 cycles, weight 189 lbs.

Prompt Delivery—Write Dept. RN5. 25% deposit required on C.O.D. order. Shipped F.O.B. New York.

MICHAEL STAHL, INC **39 VESEY ST. NEW YORK 7, N. Y.** **TELEPHONE WOrth 4-2882**

"ARROW" leads with Better Buys!

BRAND NEW! TUBES BRAND NEW!

304TL
Transmitting Tube $1.95 ea.

CATHODE RAY TUBES
5CP1 5FP7
5BP1 7BP7
3FP7
$1.19 each

5BP4
Cathode Ray Tube $1.95 ea.

RECEIVING TUBES

39c each — lots of 50—10% discount

954 957 9003 9006 35W4 | 2051 12AT6 12SR7 12C8 12K8 | 12BE6 864 RK34 12A6 6SJ7 | 12J5 6AT6 6SF7 5R4 36 | 6G6 Amperite 10T1 110AC Neon Light

39c each — lots of 50—10% discount

1629.....15c each 1625.....19c each 7193.....19c each

SPECIAL TUBE OFFERS

841—79c ea.
839—$2.95 ea.
837—$1.95 ea.
832A—$2.95 ea.
2J32—$20.00 ea.
869B—$25.00
2C26A—49c ea.

DYNAMOTORS AND INVERTERS

BD-77, Dyn. Unit 14v in, 100v, 350 ma out, with relay fuse box and filters $5.35
DM-21 Dynamotor; Part of BC-312 and BC-314, 14v in, 235v, 100 ma out.....$2.47
DM-34 Dyn: 12v in, 220v, 80 ma out.....$2.29
DM-35 Dyn: 12v in, 625v, 225 ma out $3.25
PE-101-C Dyn. Unit: 12 or 24v in, outputs 800v, 20 ma, 400v, 135 ma, 9v, 1.1A.....$2.75
PE-55Dyn. Unit: 12v or 24v in, either 16 or 25 amp, 500v out, either 200 or 400 ma....$3.75
PE-206 Inverter Unit; rotary converter, 28v in, 80v at 500 VA, 800 cy. out 3.95
PE-103 Dynamotor, used $6.95
DM32A—each.....95c 3 for $2.00

BIAS METER
Brand New

Originally used for measuring voltages and teletype and telephone equipment. Can be used for measuring DC voltages and bias voltages also checking polarity of DC voltages. Complete with adaptor plug and schematic. Enclosed in metal carrying case. Requires no batteries for operation .....$3.95 ea.

ELECTRONIC MEGAPHONE
Brand New

Only 40 of these to sell. Amplifier straps on shoulder, then just hold megaphone and speak in mike mounted on rear of projector. Amplifier is conventional type, shipped with tubes. Amplifier-dry battery operated less battery ONLY **$29.95**

SCR-522 VHF COMMAND UNIT

2-Way Radio; freq. range 100-156 MC.; complete with crystals, tubes, plugs, dynamotor . . . used, in excellent condition.....**$24.95**

ARC 4 TRANSMITTER and RECEIVER

For operation VHF frequencies in range of 140-144 mc. Four channel crystal controlled, manufactured by Western Electric—24V operation. Complete with crystal and dynamotor. Used. Good condition.....**$19.95**

PE-117 UNIVERSAL POWER SUPPLY

6 or 12 volt input; output 145 volts and 90 volts; less vibrator, voltage regulator and rectifier tube; ideal mobile power supply unit; excellent condition, each **$2.95**

POWER SUPPLY FOR BC-223 PE-125 VIBRATOR TYPE

12 or 24 volt input DC; output 475 volts-200 ma. 8 volts DC at 4.5 amps. BRAND NEW with schematic diagram.....**$8.95**

RA-10 BENDIX RECEIVER

3 band, good cond., 7 tube super heterodyne circuit, direction finder and communication receiver, freq. range 200 to 110 KC and 2 MC to 10 MC, complete with dynamotor and tubes, easily converted to operate from 110 volt AC-DC **$14.95**

SELSYN INDICATORS

For use with beam rotators for indication of direction of beam. Operate from 15-24V, 60 cycle AC supply. Small model, 3 inch diameter, only **$2.45**
Large model, 5 inch diameter, only..... **2.95**

GE METER

0-10 amps., DC.....each **$2.29**

OUTPUT TRANSFORMER

Hi-Fi; used is Scott-made Navy receiver. Fully potted. Pri. 5000 ohms, output secondary 600 ohms CT, inverse-feedback secondary 60 ohms CT, ONLY **$1.49**

RADIO SET SCR-AR-283

BRAND NEW . . . transmitter and coil sets to cover 2.5-7 MC., transmitter tubes 2 No. 10 special and 2 No. 45 special, receiver (less the 2 receiver coil sets), receiver tubes 1—37, 1—38, 4—39/44, shock mounts, dynamotor (24 V.), antenna switching relay, receiver control box, transmitter control box, charts, dials, and instruction manual . . . ONLY.....**$14.95**

PHANTOM ANTENNA
Brand New

Used with any 80 meter transmitter as a dummy load for adjusting transmitter for maximum output before going on air. Freq. range: 2MC to 4.5MC, with instruc. manual, enclosed in metal case with cover.....$1.95 ea.

SPRAGUE PULSE FORMING NETWORKS

Used in small radar modulators, available in 3 sizes, 67 ohms impedance. 7.5 Kilowatt rating.
H-603, one micro second, 200 pulses per second **$1.95**
H-601, 3 micro seconds, 200 pulses per second **2.95**
H-602, 16 micro seconds, 60 pulses per second **3.95**
ALL THREE ABOVE FOR ONLY... **4.95**

OIL-FILLED CONDENSERS

.25 MFD at 1500 VDC..... 59c
.25 MFD at 15,000 VDC.....$4.95
2 MFD 220 VAC 29c

.25 MFD at 6000V DC.....$1.49
2 MFD at 600V DC ..... .29
4 MFD at 220V AC..... .29
.5 MFD at 750V AC..... .29
2 X .25 at 2000V DC..... .29
3000 MFD at 3V DC ..... .19

ARROW SALES, INC.

MAIN OFFICE
59 WEST HUBBARD ST., CHICAGO 10, ILL.
Telephone SUPerior 5575

SOUTH SIDE BRANCH
8310 SOUTH HALSTED ST.

NORTH SIDE BRANCH
1802 NORTH HUMBOLDT BLVD.

"ARROW" leads with Better Buys!

SCR-274 MEDIUM FREQUENCY COMMAND SET

Complete nstallation with 2 transmitters, 3 recevers, racks, tubes, crystals control box and plugs.
Excellent condition **$24.95**

BLOWER MOTOR

24V, small portable with fan, ideal for defroster or ventilator unit, 17,000 RPM, BRAND NEW..... **$1.95**

TEST CABLE

Coaxial cable used for connecting signal generator to receiver, complete with PL-55 on one end, 2 spare terminals on other end; shielded, 6 ft. long, NEW **19c**

CD-307 Phone Extension Cord PL-55 on one end and JK-26 on other end, 8 ft. long, used for extension of headsets or speaker **29c**

AUTOMATIC FREQUENCY CONTROL UNIT

Western Electric type used for controlling frequency for teletype and telephone work, complete with 3—6SJ7 and 2—6H6 tubes. Complete unit, brand new in original box... **$4.95**

BC-604 FM 35 WATT TRANSMITTER

A-1 condition, complete with tubes, 10 channel push buttons, less crystals and power supply, each **$10.95**
Set of 80 crystals for above..... $14.95
BC-603 Receiver for above..... 10.95

BC-788 FOR 420 MC

Complete with tubes. Excellent cond. Complete transmitter-receiver. 14 tubes including 3-6J6; 9-6AG5; 1-6L6; 1-5Y3. Six wide band IF stages. Has 98.356 KC crystal. Details on page 53 of "QST", Nov. 1947, ONLY.. **$10.95**

PE-151 INVERTER

12V DC input; 115V AC output; 150 watts; ideal power supply for mobile work and sound systems, BRAND NEW **$12.95**

Wave Meters

		Each
Freq. range:	22 to 30 meg.	**$7.95**
Freq. range:	37 to 53 meg.	
Freq. range:	155 to 230 meg.	

AC operated, complete with carrying case and magic eye for tuning indicator, vernier tuning dial.

FILTER CHOKES—All Fully Enclosed

2.7 H. @ 145 MA. DC., 125 ohms DC. Res. **59c**
4 MTG. Studs, each.....
100 mi 10H.....59c

APN-1 RADIO ALTIMETER

Complete 420 MC transmitter-receiver unit, complete with all plugs, indicators.
BRAND NEW..... **$34.50**

AN/PRS-1 MINE DETECTOR—BRAND NEW

.....$9.50
PE-103 DYNAMOTOR . . . used..... 5.95

BC-929-A

Contains power supply 110 V. 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes. Each $17.95; Used, ea.....$14.95

R-78/APS-15

Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes.
Each **$39.50**

BENDIX COMPASS RECEIVER MN-26

Remote control commercial type navigational receiver. Indicates direction of any desired transmitting station. 3 bands—frequency range: 150 Kc to 1500 Kc; has 12—6 V. type tubes. Brand new, original cost $600.
Now **$24.95**
Accessories for Above:
Loop MN-20 .....$6.95
MN-28 Control Box..... 5.95
MN-52 Loop Control Unit..... 1.95
Loop Transmission cable—168" long..... 8.95

T-17B HAND MIKE

BRAND NEW . . . perfect carbon-hand mikes, light wt., 200 ohms, single button, press to talk switch, 5 ft. rubber cord, plug, dust cover.
ONLY **89c**

COMMAND RECEIVERS and TRANSMITTERS

(274N Series)—Complete with Tubes

	NEW
BC-454A; 3 to 6 MC.....	**$5.95**
BC-458; 5.3 to 7 MC	**5.95**
BC-457; 4 to 5.3 MC.....	**5.95**
BC-456 MODULATOR.	
Brand New	**2.95**

RECEIVER

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Voltage, Current, Capacitance, and Resistance MEASURING DEVICES

A complete technical analysis of the many basic types of test circuits used in radio servicing.

THE equipment described in this article is not limited to use in the radio servicing field, but is fundamental to the repair of all types of electronic equipment. Such instruments do, however, form the basis and the framework around which the equipment of a radio service shop is built.

The fact that these instruments are used for the measurement of fundamental quantities such as voltage, current, capacitance, and resistance offers the fortunate assurance that such meters will not become obsoleted by development of newer types of test equipment of a more specialized nature.

These instruments can be broadly classified into two groups:

1. Single purpose instruments which are used for the measurement of only one electrical characteristic or quantity.

2. Combined instruments in which a single meter movement or electron ray indicator tube is employed for the measurement of a number of different quantities by using selector or function switches. These combined types are known as multimeters or analyzers.

Another classification can be made from the standpoint of portability:

1. Pocket type or small instruments which can be taken on outside service calls or which may be used to check equipment in its cabinet or on the bench.

2. Panel type instruments which are normally installed in a fixed location on the service bench.

The factors which govern the purchase of test instruments involve the following considerations:

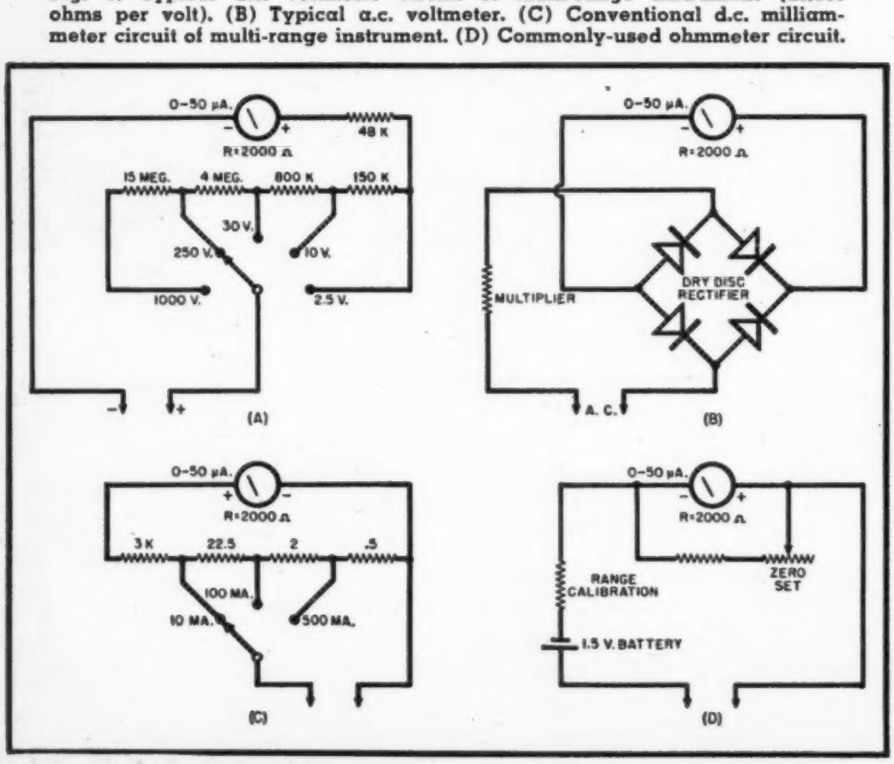
1. The total investment contemplated.

2. The accuracy, sensitivity, ruggedness required for the type of operation intended.

3. The probability of requiring the simultaneous use of more than one piece of equipment.

The relative importance and necessity of these factors will be included as a part of the discussion of the various instruments.

Fig. 1. Typical d.c. voltmeter circuit of multi-range instrument (20,000 ohms per volt). (B) Typical a.c. voltmeter. (C) Conventional d.c. milliammeter circuit of multi-range instrument. (D) Commonly-used ohmmeter circuit.



Basic Indicators

The two basic devices used as indicators in present radio service test equipment are the electron ray indicator tube and the indicating meter.

1. *Electron Ray Indicator Tube.* The electron ray indicator tube is basically a voltage sensitive device. In general two types exist; the electron ray indicator tube alone and the indicator with a built-in triode amplifier. This latter type with sharp cut-off characteristics is the one usually employed in test instruments. This type is characterized by the 6E5. It normally takes from 3 to 8 volts applied to the grid of this tube to close the shadow angle to zero. For more sensitive applications amplifiers are often used. Frequently the electron ray indicator tube is employed in bridge devices to indicate a zero or balance point. In this case, the operation of the electron ray

* Our thanks to Howard Browning for permission to reproduce this speech which was originally presented at the "Town Meeting of Radio Technicians" held at the Bellevue-Stratford Hotel in Philadelphia.

indicator is for a minimum signal and the point of measurement is determined by the maximum shadow angle. As the measurement departs from the correct point in either direction, the shadow on the target will tend to close. Electron ray indicator tubes are inexpensive, universally available for replacement, and satisfactory where extreme accuracy of measurement is not required.

2. *Indicating Pointer Type Instruments.* Indicating pointer type of instrument is the heart of any service test equipment which uses it and any equipment employing this type of indicator is only as good as its basic meter movement. There are many types of basic meter movements, the most common of which are:

1. The moving coil permanent magnet or d'Arsonval,
2. Moving coil—fixed coil or Dynamometer,
3. Moving iron vane, and
4. "Hot wire" type.

Of these the d'Arsonval movement is by far the most widely used in radio service test equipment; primarily because of its ruggedness, basic sensitivity, and the fact that its indication is directly proportional to the current through the moving coil. For the purpose of this discussion we will consider only the d'Arsonval type instrument.

Voltmeters

At the start, it should be pointed out that the d'Arsonval movement is essentially a current measuring device and in any application, no matter what the electrical quantity being measured, the meter indication will always be in terms of a direct current through this movement. D'Arsonval type meter movements are classified by their current sensitivity; and the two most popular types for radio servicing equipment require currents of 1.0 milliampere and .05 milliampere for full scale deflection. When these basic meter movements are used for reading voltages, these sensitivities can be stated in terms of "ohms-per-volt"; and meter sensitivities of 1.0 milliampere and .05 milliampere are used in "1000 ohms-per-volt" and "20,000 ohms-per-volt" instruments. A "1000 ohms-per-volt" instrument will have a total resistance of 10,000 ohms on its 10 volt scale; because according to Ohm's law a potential 10 volts across a resistance of 10,000 ohms produces a current of exactly one milliampere. If the meter uses a .05 milliampere movement the total resistance will be 20 times as much (i.e. 200,000 ohms for its 10 volt scale) or "20,000 ohms-per-volt."

It must be remembered that any multipliers only have the effect of limiting the full-scale current of the indicating instrument to its basic sensitivity. In multiple range voltmeters (See Fig. 1A) the various series multipliers are selected by means of a switching arrangement and the full scale voltage for each range is usually noted on the meter scale. For protection of the meter in the measurement

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of voltage, the highest available range should be used and the range selector switch progressively moved to lower voltage ranges until a satisfactory indication is obtained. For maximum accuracy, measurements should always be made as close to full-scale deflection as possible since the error of the instrument is normally least at or near full-scale deflection. Most commercial radio service multimeters now have an upper range, full-scale, of 1000 volts. The necessity for the measurement of high voltages will arise in the servicing of certain types of television receivers. External multipliers are available for most commercial instruments of the 20,000 ohms-per-volt type and although these external multipliers are provided with well insulated test leads, extreme care should be exercised in their use since these voltages may be lethal. In fact, many instrument manufacturers make the recommendation that the operator keep one hand in his pocket while making these high voltage measurements and this seems to be very worthwhile advice.

The a.c. voltages can be measured on the same d.c. meter movement (See Fig. 1B) by means of a dry disc rectifier bridge whose function is to provide a direct current for the indicating movement. The ranges of a.c. voltmeters are also extended by means of multipliers with their corresponding range switches. Usually the combination of the meter movement and the rectifier bridge results in current sensitivity which approximates 1000 ohms-per-volt when used for a.c. measurements.

Ammeters and Milliammeters

Since any pointer type indicating instrument is essentially dependent upon current for its operation, these instruments may be used as current measuring devices with the selection of proper shunts, (See Fig. 1C) which will limit the flow of current through the meter movement to that required for full-scale deflection. Current measurements are infrequently resorted to in the servicing of radio receivers and only then are direct currents measured. This is occasioned by the fact that the successful operation of a service shop usually does not allow the time required for the breaking or unsoldering of leads to permit the insertion of current measuring devices. In addition there is the hazard of meter burnout, since an unsuspected short in a receiver circuit can cause a flow of current that is many times normal.

Multiple range instruments, which include a dry disc rectifier bridge, often provide alternating current ranges as well as a.c. voltage ranges. Frequently, the alternating current ranges are of value in determining defects in power transformers by the measurement of current drawn from the power line or currents provided by the various secondary windings.

Multimeters

Since multimeters or analyzers for the measurement of d.c. and a.c. volt-

ages and currents are the most frequently used instruments in the service shop, it is wise to choose them with care and to acquire instruments having long scales which are easily read. The highest sensitivity instrument which is within the budget of the technician should be purchased, since high sensitivity with its consequent high effective resistance produces the least disturbance of voltages being measured.

In this regard, it should always be kept in mind that the pointer type or moving coil instrument requires power for its operation, and since this power must be provided by the circuit under measurement, the readings will be in error in proportion to the voltage regulation of the circuit. Electronic or vacuum tube voltmeters, which will be discussed in some detail later, draw extremely low amounts of power from the circuits under measurement and their use is indicated for certain specialized measurements in high impedance circuits, and for the measurement of radio frequency voltages.

Ohmmeters

Precise measurement of resistance is an operation which can best be performed by the bridge type laboratory instruments. However, it is possible to use the d.c. milliammeter as a basis for a reasonably accurate direct reading ohmmeter. The most popular circuit is one in which the leads of the ohmmeter are shorted together and an adjusting resistor used to set full-scale deflection of the meter. This indicates zero ohms on the meter scale, and is concurrent with the full-scale current of the indicating movement. (See Fig. 1D.) After this adjustment is made, any resistance inserted in the meter circuit by the use of the test leads causes less current to flow through the indicating meter and the scale of the meter is directly calibrated in terms of this inserted resistance. Different ranges are obtainable through the use of multiplying resistors and additional battery voltage. The above type of ohmmeter is usually used in commercial instruments with ranges of 1000 ohms to several megohms. A shunt type ohmmeter has been developed for more accurate readings of resistance in the range of zero to 1500 ohms and in this type ohmmeter the zero setting is made with the leads unshorted and the meter adjusted to full-scale deflection. Unknown resistances then applied across the test leads cause the meter current to be lessened by the parallel effect of their resistance. Incidentally, in this type of device the midscale reading in ohms will approximate the resistance of the meter and its associated shunt adjusting circuit. In most multimeters, operation of the ohmmeter circuits are provided by an internal battery. As this battery becomes exhausted its internal resistance increases and the adjusting resistance moves towards the end of its range. Under these conditions, the accuracy of reading is impaired and it is therefore wise to check the condi-

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This amplifier has all the facilities of the larger model and is designed with ample reserve power for most home installations. Separate inputs for radio and phono with front panel switch. Tube socket connection provides power and input facilities for magnetic pickup pre-amplifier. Tubes—1-5U4G; 3-6SG7's; 2-6SJ7's; 1-6J5; 1-6H6; 1-6SN7; 2-6L6's. Model No. NSA-2 $114.50 net, tax and tubes included, f.o.b.

The same two-tube pre-amplifier in double shielded plug-in construction used in the larger models is available for an additional $12.50 net, tax and tubes included. This pre-amplifier has built-in equalizer to provide proper characteristics for Pickering, General Electric and similar magnetic pickups.

These are laboratory amplifiers of the highest quality, designed and constructed to provide music reproduction fidelity limited only by the available signal and loud speaker equipment used. The amount of objectionable noise reduction will depend on the hearing characteristics of the individual, as well as the ability of associated pickup and loud speaker equipment to provide full range response. In general, objectionable noise is lowered to the extent of 25 decibels or more under dynamic operating conditions with response maintained to 12,000 cycles per second when music signal provides adequate masking. Output impedances of 500 ohms and 250 ohms for feeding long speaker lines or high powered amplifiers, as well as multiple standard voice coil impedances are provided on all models. All inputs are high impedances. Plug-in low impedance input transformer available on special order with large model. Cathode follower output stage on control chassis of dual chassis models permits separation of the two chassis up to more than 25 feet without line losses.

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MODEL NSA-1

2-Chassis construction—18 watts

Model NSA-1 includes the pre-amplifier using 2-6AT6 tubes as standard equipment. This model includes dual G.E. indicator eye tube for visual observation of gate action. Dynamic Noise Suppressor, tone control sections and pre-amplifier are built on one 15"x3"x7" 14-gauge aluminum chassis. Power supply and power amplifier on separate chassis 17"x3"x7". Two-chassis construction minimizes hum and simplifies cabinet installation. All power supply filter capacitors oil-filled, 600 volt paper types. Push pull 807 output tubes conservatively rated at 18 watts. Tubes—1-5U4G; 2-6AT6; 3-6J5; 2-6SJ7; 3-6SG7; 1-6H6; 2-807; 1-6AL7. Model No. NSA-1 $248.00 net, tax and tubes included.

A demand for the Dynamic Noise Suppressor in an amplifier using triode output tubes has led to the development of a special two-chassis model similar to the above in every respect except for the use of a push-pull driver stage consisting of 1-6SM7 driving 4-6B4 output tubes in push-pull parallel, conservatively rated at 18 watts. Model No. NSAT-1 $297.00 net, tax and tubes included.

Models NSA-1 and Model NSAT-1 available with 19"x8¾" 11-gauge aluminum panels or optional 5" panels. When the 5" panel is used, a separate mounting hole must be provided in the installation for the indicator eye tube.

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With the use of the basic components below, diagrams and instructions, which are provided for the RCA 630 and Crosley 307, practically any 10" set can be converted to **Projection Television.**

The gigantic picture this set is capable of projecting must be seen to be believed! **One set converted by a Los Angeles company, was demonstrated at the Shriner's Temple in Los Angeles, during the Rose Bowl game. It was viewed by 4800 people at one sitting!** A 12x16-foot rear projection plastic screen of our type was used.

F 1.9 TELEVISION PROJECTION LENS

Dimension—Length 7", Diameter 4¼". F 1.9 EF. 5 in. (127.0 mm). This lens incorporates in barrel a corrective lens for use with a 5TP4 projection tube. It is easily removable for use with flat type tubes. Lens can be utilized to project picture sizes from several inches to 7x9 feet. Made by Bausch & Lomb Optical Co. **$125.00**
Price.....
Mounting ring available for above lens..Price **$2.50**

30 KV RF POWER SUPPLY

Dimensions—Length 14", Width 11", Height 11¼". This unit has a low voltage supply separate from high voltage pack. Low voltage DC supply has control which enables you to vary voltage from approximately 12 KV to 40 KV. Unit has focus control built in for use with 5TP4 projection tube. Price, complete..... **$99.50**

STAND FOR PROJECTION TELEVISION SETS

Dimensions—23" High, 25" Wide, 18½" Depth. For use with RCA 630 chassis or Crosley table model sets. Unit mounted on ball bearing soft tired wheels. Depth is designed to accommodate RF Power Supply. Open grill allows free circulation of air. This stand a natural for mounting scopes and other lab. equipment for easy mobility. Specify whether for Television use or shop. Stand as shown in top photo.
Price..... **$31.50**

REAR PROJECTION TELEVISION SCREENS

The screen surface consists of a conglomerate arrangement of microscopic plastic crystals that "Pin Point" the projected image providing unexcelled angular viewing with a minimum loss of projected light. It is estimated that there is a loss of approximately 10% of light viewing the image at 45 degrees off center.
Light transmission percentages are controlled to obtain the maximum efficiency of the television optical projection system.
The percentage of 80% of transmission has been determined as that providing maximum efficiency.
Stock sheets are available from 3x4 feet down. Specify inside dimensions of screen desired. If larger sizes are required, they can be made to order. Frames can be had on request, small sizes $5.00—large sizes $10.00.
Price of screen, per sq. foot..... **$4.50**

Include 25% Deposit With Order, Balance C.O.D.

Pioneers in Projection Television
SPELLMAN TELEVISION COMPANY
2898 JEROME AVENUE, NEW YORK 58, N. Y.

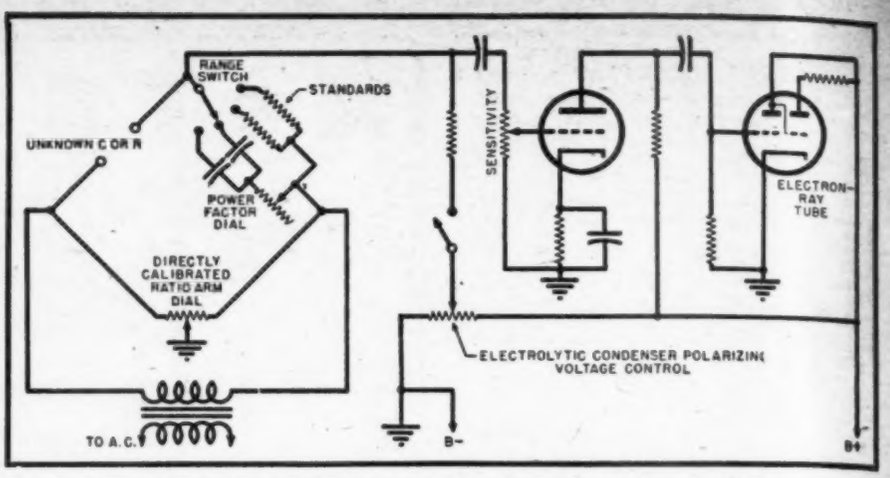


Fig. 2. Simplified circuit of a typical capacitance-resistance bridge.

tion of the batteries and replace them at regular intervals.

The application of the ohmmeter principle in multimeters and set analyzers is limited by the type and sensitivity of the basic indicating instrument, and commercial practices require that multimeters be the best compromise available to adequately serve as voltmeters, milliammeters, and ohmmeters. The electronic or vacuum tube type of instruments can provide more facilities for the measurement of extremely high resistances since most of these instruments employ a voltage comparison method of the drop across the known resistance compared to the drop across the unknown resistance.

Output or Db. Meters

The use of a signal generator in stage-by-stage servicing of radio receivers requires some type of meter connected across either the voice coil or a resistor substituted for the voice coil to indicate standard output. The provision for such an instrument is made in many multimeters by using the a.c. voltage ranges of the instrument with the scale calibrated in terms of decibels, and the coupling to these a.c. ranges is furnished by a rather large paper condenser. Meters not specifically equipped with db. ranges can be used as output meters taking zero db. level as 1.73 volts across a 500 ohm load, and by proceeding from this point to the calculation of power ratio in the particular load used.

Summary

Voltmeters, ohmmeters, and milliammeters commercially available as multi-purpose instruments and on which measuring functions are selected by means of function and range switches, commonly provide ranges with the following full scale values:

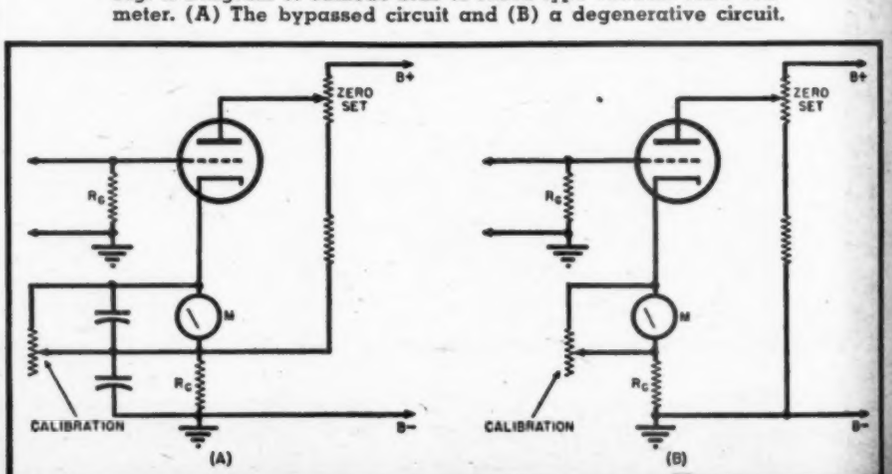
a. On d.c. volts 3 to 5, 10 to 15, 30 to 50, 75 to 100, 250 to 300, 500 to 600, and 1000 to 1500 volts at sensitivities of 1000 ohms-per-volt and/or 20,000 ohms-per-volt or 25,000 ohms-per-volt.

b. The a.c. voltage ranges are usually the same with a sensitivity of 1000 ohms-per-volt.

c. The usual direct current maximum scale ranges are 50 microamperes, 100 microamperes, 1 milliampere, 10 milliamperes, 50 milliamperes, 250 milliamperes, 500 milliamperes, and 1 ampere. In some cases, the lowest (50 microamperes) and the highest (10 ampere) current ranges are provided by separate jacks or binding posts and are not a part of the multiple switch deck.

d. For measuring a.c. amperes. Some instruments provide for the

Fig. 3. Diagram of cathode-bias or reflex type vacuum tube voltmeter. (A) The bypassed circuit and (B) a degenerative circuit.



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This unit was built for R.C.A. Add a final—becomes a complete transmitter with signal shifter. 2:20 mg —also FM—only a few cycles drift from cold start. Complete with regulated power supply and heavy duty deluxe rack. Power supply is electronically regulated 330 v. output—maximum current 400 mills—½ v. variation between no load and full load output—uses 10 tubes: 5—6Y6G: 2 — 5U4G: 2 — VR150/30: 1 — 1852 — Perfect for Television sweep circuits for field or station use or wherever 300 v. must be maintained under varying load conditions. Write for free illustrated folder giving complete details.

COMPLETE (less tubes)..... **$225.00**

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TUBE KITS

Complete set of tubes for SCR-522 **$17.95**

Complete set of tubes for BC-348 **$7.95**

Complete set of tubes for BC-312 **$7.95**

Specify Model Numbers

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SPECIAL

Synchronous Type

Pair in Series for 110v. AC.

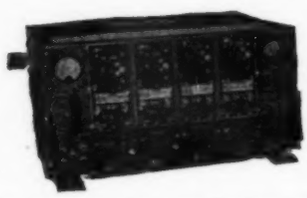
Type I—6¼" long, 3" dia.—50 v. AC, 50 cy.—4 lbs. ..... $ 9.95 pr.

Type II—8" long, 4¼" dia.—115 v. AC. 50 cy.—11 oz..... 12.95 pr.

SYNCHRO—DIFFERENTIAL

Model #1943 — C78249-CAL-11280 Bendix Aviation 115 v.—60 cy. 6" length to end of shaft x 4¼" diameter ..... $ 9.95

TRANSMITTER BUY OF 1948



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Separate Ant. Tuning units covering the following frequencies:

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1500-3000 Kc.
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Tube line-up as follows: RF Osc. 6L6-RF Amp. 814—Audio—6SL7 Pre Amp. into 6L6 driver and side tone amplifier with pair of 6L6 modulators, screen oscillator tube, regulated with VR 150 Tube. All circuits are metered.

10½" high, 12¼" deep, 21½" long. Shipping weight 100 lbs. Price, F.O.B., New York City.

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Niagara can supply a power supply kit which will completely power the ARC 5 Transmitter used as a VFO or any one of the ARC 5 receivers. All basic components included for delivering 300 v. @ 150 mills & 24 v. or 12 v. for the filaments — no rewiring of equipment necessary. This kit will also power the BC-348, BC-312, and the BC-1206. A good buy at $7.50

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We have a complete power supply containing all the necessary parts down to the line cord, pilot light switch & terminal blocks & delivers the following voltage—300 v. DC @ 250 mills, 150 v. of regulated bias and sufficient 12 v. to operate the tubes of both receiver and transmitter. Complete at the amazingly low price of $14.95

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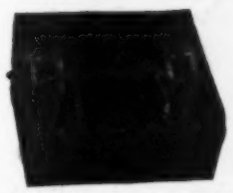

Summer is here—Now is the time to be thinking of your portable rigs. These 12 v. dynamotors are ideal to power your portable 2 meter rig—low battery drain—235 v. output at 90 mils. Can be run at 50% overload—gives up to 110 mils at 215 v. without damage for continuous duty—complete with filter 6¼" x 5¾" x 3½".

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Leads out the bottom
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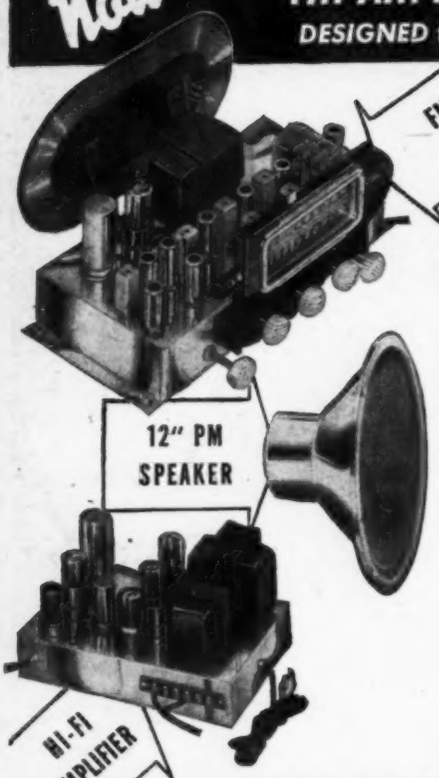

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40 mfd.	150V	.23	2.04	19.74
50 mfd.	150V	.24	2.14	20.45
20-20 mfd.	150V	.29	2.49	22.98
30-20 mfd.	150V	.32	2.95	25.98
40-20 mfd.	150V	.36	3.25	29.95
50-30 mfd.	150V	.39	3.49	32.98
8 mfd.	450V	.21	1.99	19.50
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16 mfd.	450V	.39	3.74	33.78

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.05	600V	.06	.55	4.95
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.25	600V	.11	.98	8.95
.005	1700V	.14	1.25	9.95
.007	1700V	.14	1.25	9.95
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An assortment of 50 of the above By-pass condensers. Fine value for the small shop or experimenter, only $2.98

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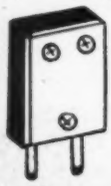
100 assorted ½-½-1 watt carbon resistors. All RMA color coded. Special $1.29.



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measurement of a.c. amperes in the range of ½ to 10 amperes.

e. Ohmmeters usually cover a span of from zero to 100 megohms in 5 ranges.

Capacitance and Resistance Measurement Devices

The normal method of measuring capacitance is by means of an alternating current bridge in which the unknown condenser becomes one arm of the bridge. An internal standard condenser comprises another arm, and measurement is accomplished by varying resistance ratio arms. (See Fig. 2.) In most cases, the point of balance of the bridge is indicated by the use of an electron ray indicator tube. Several instruments on the market employ pointer type meters for indication of bridge balance. Capacitance bridges provide a number of ranges to enable the measurement of mica, ceramic, paper, and electrolytic types.

The degree of balance of any arc bridge is affected by both the reactance of the condenser and its resistance. For this reason, additional controls are provided on these bridges to balance the out-of-phase or resistive component, and the final setting of this control can be taken as an indication of the losses of the condensers. This control is usually calibrated in terms of power factor. Electrolytic type condensers which in most radio applications are of the polarized type, operate in the receiver with d.c. voltage of the proper polarity impressed across the condenser. Accordingly provision for an adjustable polarizing voltage of the correct value is usually made in a condenser checker. Since alternating current bridges of the various types designed for capacitance measurement can readily be converted by switching to pure resistance bridges, this class of instruments usually has resistance as well as capacitance scales, and many such types are commercially available. In a few capacitance-resistance bridges, other features are provided which enable the suspected condensers to be spot checked quickly on a "good or bad" basis without their removal from the circuit. Other features sometimes included in this type of instrument are the provision for measurement of direct current and voltage although the instrument is not primarily intended for this purpose.

Some multimeters are provided with capacitance scales which employ the 60-cycle power line as a source of standard voltage and measure the alternating current through the condensers, the scale or scales being calibrated directly in microfarads.

Electronic Multimeters and V.T.V.M.'s

As previously noted in this article, an undesirable feature of the indicating instruments which are directly connected with circuit components for voltage measurements is that these instruments must draw power, which though small may upset accurately

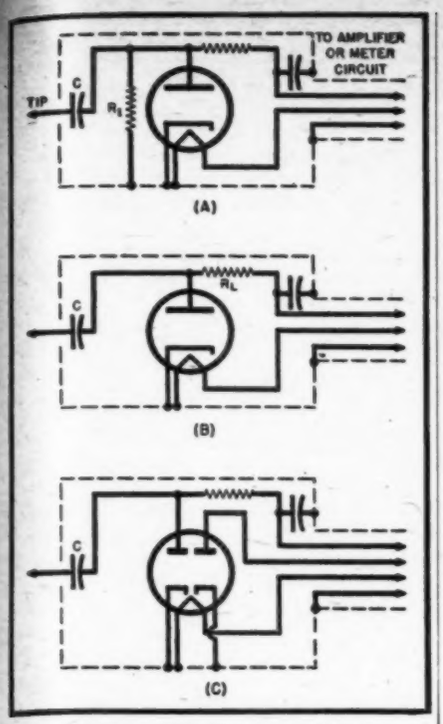


Fig. 4. Diode probe circuits. (A) Parallel input load and filter, (B) series load and filter combined, and (C) dual diode for use with balanced circuits.

tuned circuits or cause incorrect voltage readings. For this reason primarily, the electronic or vacuum tube voltmeter was developed. This instrument is essentially a device which isolates the indicating instrument from the circuit under measurement; and many different circuits have been developed which will perform this function.

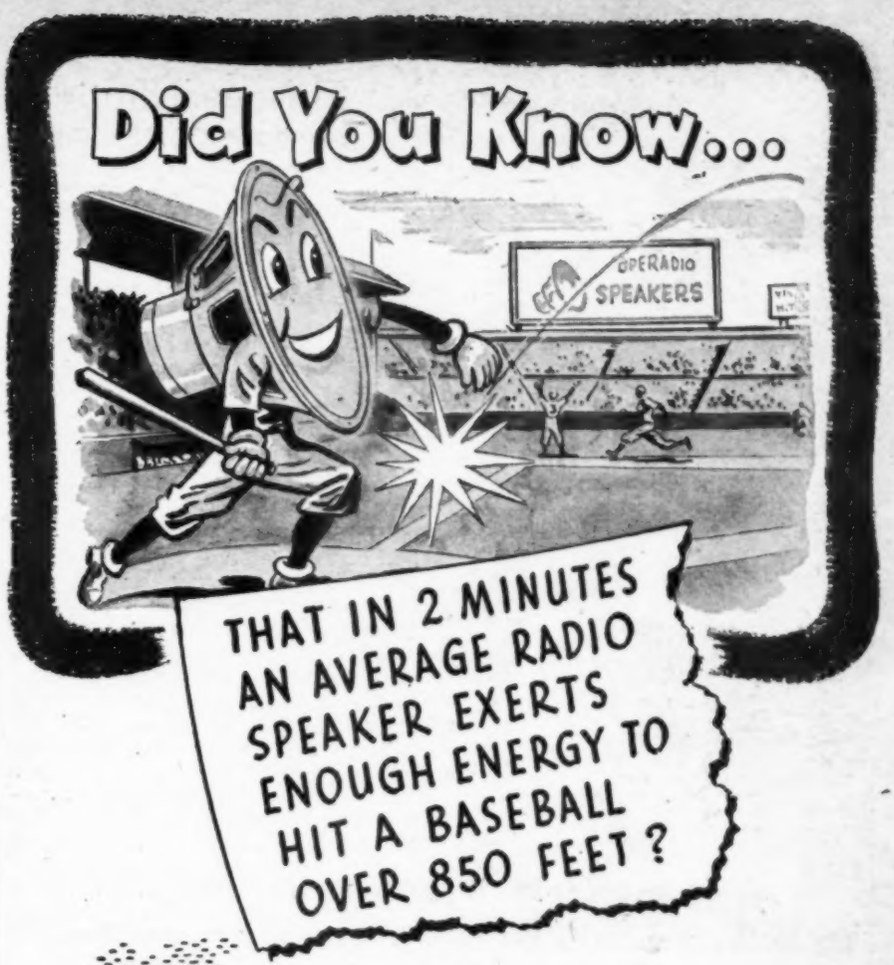
Classification of V.T.V.M.'s

Vacuum tube voltmeter circuits may be classified with regard to use. These are three principal functions:

1. Measurement of d.c. voltages.
2. Measurement of audio and low frequency r.f. voltages.
3. Measurement of radio and u.h.f. voltages.

1. *Measurement of d.c. Voltages.* The instruments for this purpose may provide for reversal of polarity by means of switching and, in this case, the test leads need not be color-coded or marked. In many instruments, the d.c. measurement probe contains an isolation resistance of from 1 to 3 megohms located immediately behind the contact point. This assures a very low input capacitance which combined with the rest of the voltmeter input circuit provides negligible loading in the average radio circuit. It should be noted that the use of such an isolation resistor makes it possible to measure d.c. voltages in circuits which are operating with r.f. or a.f. voltages superimposed. The d.c. voltage measurement is not affected by the presence of the other voltages and the circuit operation is not disturbed by the measment.

2. *Measurement of Audio and Low Frequency r.f. Voltages.* In instru-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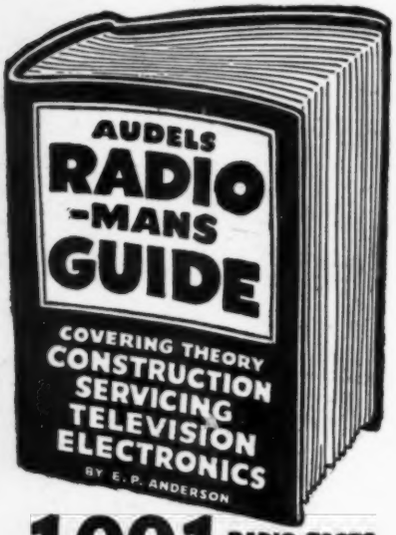

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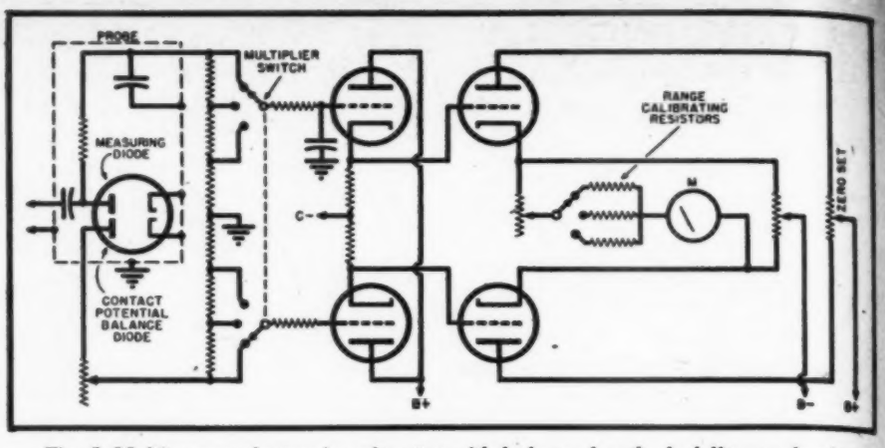

Fig. 5. Multi-range electronic voltmeter with balanced cathode follower circuit.

ments for this purpose the vacuum tube and its associated circuit are normally mounted within the instrument and connections to them are made by pin-jacks and ordinary test leads. The input circuit has a coupling condenser that is large enough to assure response to the low audio frequencies in the neighborhood of 60 cycles. This type of voltmeter is superior in its capabilities to the dry disc rectifier type instrument previously described since such rectifier instruments rarely have sensitivities higher than 1000 ohm-per-volt; whereas the a.f. vacuum tube voltmeter may have input resistance in the order of 10 megohms or more.

In addition, the vacuum tube voltmeter will have good accuracy over the entire audio range; whereas the dry disc rectifier type meter falls off in response at the higher audio frequencies.

3. *Measurement of Radio and u.h.f. Voltages.* The r.f. probe type instruments employ a vacuum tube, usually of the miniature or subminiature type, mounted directly in the measurement probe and in which the input circuit design features low capacitance and a very high natural resonant frequency. Some of these instruments permit measurement to as high as 300 megacycles. The probe type instrument cannot replace the other two mentioned above since the low coupling capacity required causes the measurement to be in error in the audio frequency range.

Classification as to Type of Circuit

Since the vacuum tube voltmeter is essentially an application of the detection or demodulation principle, all of the methods of operation of a vacuum tube as a detector may be employed in designing a vacuum tube voltmeter. These include grid rectifier types commonly known as grid leak detectors, plate rectification types, cathode bias or reflex types, diode rectifiers, and "slide back" bias types. The choice of circuit type depends on several factors such as the functions of the instrument as discussed above, the necessity for combining several functions in one instrument, cost of design, and susceptibility to variations due to line voltage fluctuation, tube aging, tube replacement, and contact potential effects. Many instruments employ direct current amplifiers, bridge circuit amplifiers, and cathode follower circuits. Since the foregoing circuit types have been used in many combinations, it is felt that an individual description of circuits with a few examples of their combined use may be of value.

Slide-Back Voltmeters: The slide-back voltmeter was a very early application of vacuum tubes to voltage measurement. It is essentially a plate circuit detector in which the input signal causes an increase of plate current as indicated on a pointer type meter. The bias voltage, which is also indicated on a meter, is changed by means of a control to restore the plate meter reading to the value which it read prior to the measurement. The change of bias voltage is equal to the peak voltage under measurement. This type has been abandoned since it is not direct reading and does not accommodate itself to multi-function instruments.

Grid Rectifier Meters: The grid rectifier or grid leak detection meter, also an early type, actually combines diode action in the grid circuit with amplification in the plate circuit of the same tube. Its use has been superseded by separating these functions so that wider range multi-purpose instruments may be commercially available.

Cathode Bias or Reflex Type: This type employs a meter in the cathode circuit in series with a resistor which develops bias potential from the plate current. (See Fig. 3) There is no load in the plate circuit which either returns directly to "B-plus" or to an adjustable plate voltage for the purpose of zero setting the instrument. The grid circuit is normally returned to "B-minus" through an extremely high resistor in the order of 10 megohms. The cathode bias resistor is of such a value as to reduce the plate current to a point near cut-off; and, for this reason the circuit is another form of plate rectifier. An alternating voltage or a positive potential on the grid will cause an increase in plate current and an upward reading of the meter in the cathode circuit. The circuit is of value in measuring instruments since it can be used for both a.c. and d.c. measure-

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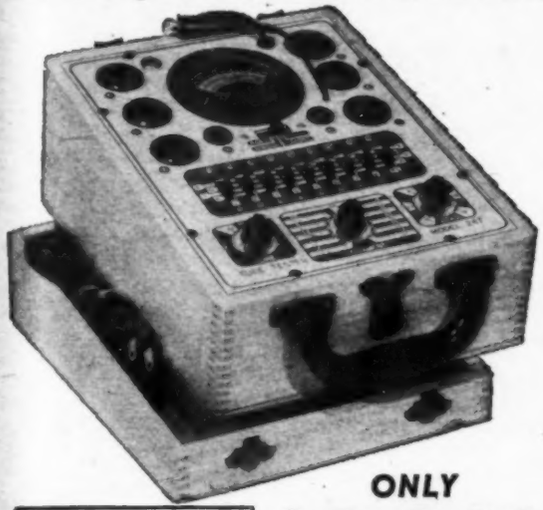

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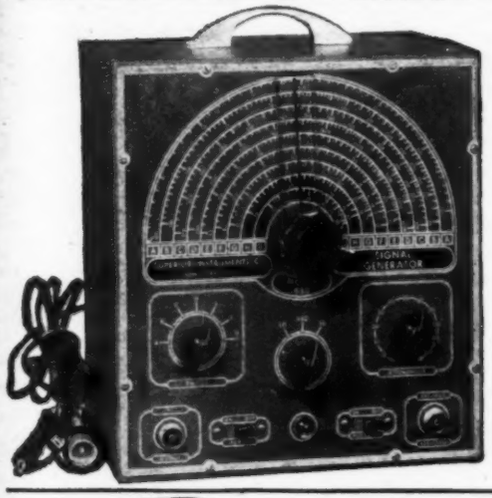

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ments. The bias resistor and the meter circuit may be bypassed for high sensitivity or may be left unbypassed to obtain a longer range due to the degenerative action of the unbypassed bias resistor. This circuit has sometimes been referred to as a d.c. amplifier since it can be directly connected to a diode probe. This allows a multiple instrument in which a.c. voltages are measured by the probe and d.c. voltages by switching directly to the cathode loaded tube.

Diode Rectification Type: In practically all the u.h.f. probe type instruments, of which a number have appeared recently on the market, a diode or a double diode is positioned with its input circuit elements in the end of a probe. (See Fig. 4) The development during the war of subminiature or proximity type tubes of extremely small dimensions with very low interelectrode capacitances and high resonant frequencies have provided the instrument design engineer with a new and extremely useful tool. The probe input circuit consists of a small coupling condenser between the contact point and the diode plate. Parallel leak resistance of a high value usually 10 megohms or more connects the diode plate with the cathode which in turn is connected to the metal shell or ground lead of the probe. A filter circuit consisting of a resistor of from 1 to 5 megohms followed by a parallel condenser of approximately .002 μfd. is used to isolate the diode from the grid of the meter tube in the instrument case. This combination will present input characteristics of from 2 to 10 μμfd. with parallel resistances of from 5 to 10 megohms depending upon the design of the particular probe circuit. One problem presented by the diode in calibration of the instrument and in interchange of tubes on replacement is that of contact potential.

In any vacuum tube an element having a potential nearly equal to the cathode will assume a negative charge due to electrons received from the cathode. This is the so-called "space charge," and the presence of this space charge effect prevents the rectified output from being linear with respect to the input at low input levels. Certain designs of vacuum tube voltmeters overcome this space charge or contact potential effect by feeding a small positive bias to the diode plate through an extremely high parallel resistance. In more recent circuits, advantage has been taken of the fact that dual diodes are available in miniature size tubes and the contact potential of the other diode is employed to balance that of the measurement section. This has been accomplished by the use of a balance type circuit in which each tube is of a dual type with an identical section to perform the balance function. Such an arrangement has the advantage that line voltage fluctuations and the drift characteristics of the tubes with age are balanced. An additional feature is the fact that the replacement of any tube will auto-

matically rebalance the circuits since each section and its twin are likely to have identical characteristics.

Balanced Cathode Follower Metering Circuits: A recent and popular type of circuit which combines a number of the features covered consists of a dual-diode r.f. probe followed by a dual-triode cathode follower coupling tube, which in turn feeds another dual-triode cathode loaded meter tube. (See Fig. 5) Such a combination isolates the metering circuit from the range switches, allows the measurement of direct currents of either polarity and in conjunction with the diode probe permits measurements of a.c. voltage to be taken over the entire range including the highest contemplated FM and television frequency assignments.

The most recent multiple instruments combine the electronic voltmeter principle with the measurement of resistance, alternating current, and capacitance.

In conclusion it is suggested that the following factors be considered when contemplating the purchase of this class of service instruments: 1. range of measurement; 2. basic sensitivity; 3. accuracy required; 4. clarity of scale presentation; 5. stability; 6. ruggedness; 7. quality of components employed.

Since these devices will be in daily use in the radio technician's shop over many years, careful choice should be made from the lines offered by established manufacturers of known reputation and integrity. —30—

Freak TV Reception

THE San Diego area has one-hundred television receivers in operation in spite of the fact that the nearest TV transmitter is 115 miles away!

Harry R. Lubcke, Director of Television for the Don Lee Broadcasting System, reports that television fans in San Diego agree that when the weather is "right" they see television in San Diego as clearly as persons viewing the programs in Los Angeles.

According to Mr. Lubcke, although San Diego is considerably below line-of-sight the television waves are gradually bent around the surface of the earth by a convenient coastal "temperature inversion". That is, warm desert air normally overlays the cool ocean air at elevations above 2000 feet. This is in the "tropospheric region" of the atmosphere, the region which affects almost all weather; hence the correlation between weather and this long distance television transmission. A "frontal disturbance", namely a rainstorm, destroys the above stratification and the signals from Hollywood drop to an undesirably low value. San Diego viewers claim that they can predict a storm because television reception drops out a few hours before.

In San Diego television receiving antennas are characterized by their considerable height and complexity. It is usual to see a half-dozen horizontal elements atop a forty-foot pole located on the highest portion of the building being served. It has been reported that the most successful installations are near the ocean. —30—

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Manufacturers' Literature

CARRIER TELEPHONE

The *Lenkurt Electric Co.*, of San Carlos, California have recently published a 68 page bulletin covering their Type 32 Carrier Telephone Systems.

This bulletin covers frequency allocations for carrier telephone, and continues with descriptions of the terminals, repeaters, pilot regulators, and auxiliary units which make up the system.

Auxiliary units discussed include; voice-frequency terminating equipment, ringdown signaling gear, carrier-frequency dialing facilities, carrier-transfer equipment, voice-frequency repeater-balancing devices, bridged-station filters, autotransformers, repeating coils, relay racks, test units, and power supplies.

Performance details are included, and a useful appendix provides engineering data on line attenuation and cable losses, together with information required in planning a carrier system.

Further information may be obtained by writing to the *Lenkurt Electric Co.*, 1115 County Road, San Carlos, California.

"ENGINEERING NEWS"

The second issue of "Engineering News" has been issued by the *American Phenolic Corporation*. This is a resumption of the prewar "Engineering News" which was suspended during the war.

In this second issue is an article by Charles Adams called "Industrial Electron Tube Sockets" in which Mr. Adams discusses materials and design of the new *Amphenol* sockets.

A copy of the booklet may be obtained from the *American Phenolic Corporation*, 1830 S. 54th Avenue, Chicago 50, Illinois.

RADOLEK CATALOGUE

Of interest to radio servicemen, amateurs, experimenters, and engineers is the announcement of the new enlarged 64 page catalogue just published by *The Radolek Company*.

This catalogue contains many new items that have only recently become available. These include merchandise that was discontinued during the war plus a complete showing of all the standard parts and supplies essential to those engaged in the electronic and radio service fields.

A free copy of this buying guide may be obtained by sending your name and address to *The Radolek Company*, 601 W Randolph Street, Chicago 6, Illinois.

EQUIPMENT HOUSINGS

Par-Metal Products Corp. have announced the release of a new catalogue listing various housings for electronic equipment.

This catalogue presents a complete description of cabinets, chassis, panels, racks, and accessories as applied to electronic apparatus.

A copy of this catalogue may be obtained by writing to *Par-Metal Products Corp.*, 35-62 49th St., Long Island City 3, New York.

REPLACEMENT GUIDE

A new guide to phonograph crystal replacement entitled "*RCA* Crystal-Pickup Data Folder" has been released by the *RCA Tube Department*.

This folder shows the exact crystal replacement to use in the different models of *RCA Victor* phonographs. Outline diagrams of the crystal cartridges used in the pickup arms of all models of the company's phonographs are also shown. The diagrams show the shape, mounting holes, and other necessary information for easy installation of each cartridge. In addition, the folder contains two indexes. The first lists *RCA* phonographs by model number and shows the proper crystal replacement for each. The second lists the crystals by stock number and shows phonographs in which they may be used.

The "Magic Tone Cell" and the newly announced "Silent Sapphire Crystal Pickup" are also described in the folder, together with indexes showing how they may be used as "universal" replacements in many pickup arms. The "Magic Tone Cell" may be used for modernization of 69 different *RCA* radio-phonograph models. The "Silent Sapphire Crystal Pickup" is smaller in size and may be used to replace 70 different crystals used in a large variety of makes and models of phonographs produced by other manufacturers.

This guide is available to all radio servicemen and dealers through *RCA* Parts Distributors.

TRACERLOG

"Tracerlog," a booklet issued by *Tracerlab, Inc.*, contains articles of general interest to those working in the field of radio-activity for research or industrial control problems.

Featured in this booklet is the *Tracerlab* SU-3 Laboratory Monitor developed for use as a routine contamination monitor in radio-activity laboratories. The instrument comes completely equipped, including a thin end-windowed sensitive Geiger tube, enclosed in a detachable probe assembly and connected to the instrument by a flexible cable.

The SU-3 may be used for many applications including checking laboratory bench tops for contamination from very low energy Beta emitters such as the C-14 and S-35. It may also be used for checking laboratory glassware, fingertips, and lab coats for contamination, and monitoring of laboratory "background" counting rate to detect large scale fluctuations from various causes that might interfere with precise radioassays in progress.

The booklet is available, free of charge, from *Tracerlab, Inc.*, 55 Oliver Street, Boston 10, Massachusetts.

"MAGNETAPE" RECORDER DATA

A new circular covering the "Magnetape" Recorder manufactured by *Amplifier Corp. of America* has recently been released.

Uses, applications, and complete operation of this tape recorder are described in this circular. This recorder may be equipped with voice-activated, start-stop mechanism and an automatic repeat-reverse control for transcribing as optional built-in features. The reverse control allows the typist to reverse the machine without unthreading the tape.

A new feature of the "Magnetape" Recorder is the constant-speed drive whereby a synchronous motor is employed to drive the capstan pulley to keep the tape feeding

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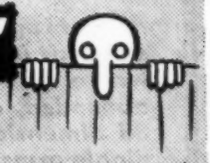

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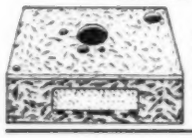
RECORD PLAYER CASE



Simulated Leather Cover. 11"x13"x5". All holes punched. A real buy
Each **59c**

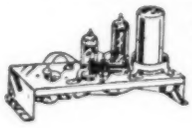
MINI VOLT METERS

A rugged, simple meter of moderate accuracy — virtually burn-out proof. Calibrated for use on AC or DC 65 to 660 Volts. Impedance approximately ½ Megohm.
List $2.50
Each $1.50

STEVENS CO-SPIRAL SPEAKER

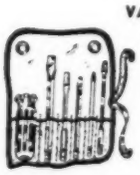
15" high fidelity speaker with a reproducing range of 40 to 16,000 cps. Power handling capacity 15 watts. Input impedance 16 ohms. Alnico V magnet weight 2½ lbs. Brings new listening pleasure to all types of high fidelity equipment.
List $80.00
Net, Each 47.04

2 TUBE WIRELESS PHONO OSCILLATOR



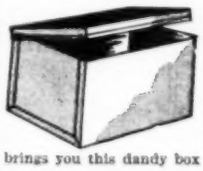
This fine piece of equipment is being sold at almost the price of the tubes alone. A real bargain while quantity lasts.
Each **$3.25**

VACO KITS



No tool rack is complete without these handy kits.
Vaco K-5 Bench Set.
Available in Screw Drive or Wrench Socket Set.
Vaco S-6 Nut Driver Kit
Each **$2.21**

YEP! WE'RE SO CRAZY WE'RE GIVING STUFF AWAY FREE!!!



Free with every order of $10.00 or more—this handy, sturdy steel parts box ideal for storing those small easily lost parts. Box measures 7¼" L. x 6¼" W. x 4⅝" D. Remember — your order for $10.00 or more brings you this dandy box absolutely free.

ALL NEW FULLY GUARANTEED STANDARD BRAND TUBES

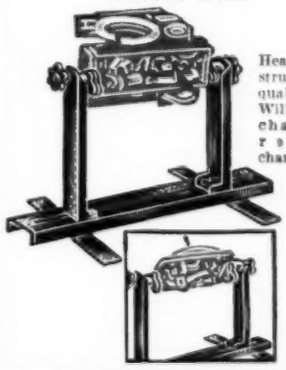
35Z5	50c	82	59c
12A6	29c	50L6	59c
50B5	59c	1LC6	97c
25L6	59c	1LN5	97c
6K7	60c	1H5	59c
117Z6	75c	1A7	59c
117L7	98c	50A5	75c
1N5	59c	12SQ7	59c
12K7	59c	35L6	59c
70L7	98c	35W4	45c
VT52	49c	0Z4	79c
7N7	50c	6N7	85c

12BE6.....59c

INSULATED WIRE

1000 feet of live rubber insulated lead-in wire. Per 1000 ft..... **$1.95**

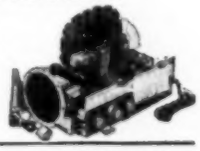
CHASSIS RACK



Heavily constructed of quality steel. Will fit any chassis or record changer. Easily adjustable to any size. Grey Crackle Finish. Each
$3.95

6 TUBE DETROLA PHONO COMBINATION AC CHASSIS

Complete with tubes, speaker, and aerial. Completely wired. $60 value.
Each.. **$14.95**



6 TUBE DETROLA AC-DC CHASSIS

Complete with tubes, speaker, and built-in antenna. Completely wired.
Each **$9.95**

"ULTRA MIKE" WIRELESS MICROPHONE

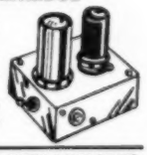
Light — Economical operation. Completely self contained. No connections to power lines. Complete with batteries, tubes, etc.
Retails at $18.00
Your price
Each **$6.63**

G. E. VARIABLE RELUCTANCE CARTRIDGE

A wonderful new magnetic cartridge that provides excellent high fidelity reproduction. Practically eliminates needle noise. Fits almost any pickup. Requires preamplifier.
List Each $7.95
Each 4.67

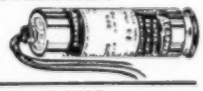
PREAMPLIFIER FOR G. E. VARIABLE RELUCTANCE CARTRIDGE

3⅝x3⅝x4½". Increases output, and equalizes cartridge for flat response. Attaches easily. Complete with tube and diagram.
List, each $9.00
Net, each 4.82



METAL CAN AEROVAX REPLACEMENT FILTER CONDENSERS

Replaces 8x8 at 600 working volts. DC test volt 800.
Each .....$ 1.29
10 for 11.75



IRON CLAMP VISE

1¾" Grip. Precision made. Holds with firm rigid grip. No wobbling or loosening of jaws. A regular $3.00 value at the amazingly low price of only
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25 POUNDS OF RADIO PARTS INCLUDING PHONO PICKUP ARM, Transformers, Condensers, Hardware, Etc. . . .
25 pound assortment of highly useful radio parts. Only..... $2.95

Write for our new, FREE 1948 Catalog . . . Terms: 25% Deposit with order . . . Balance C.O.D. F.O.B. Chicago.

Mort's Radio Shack
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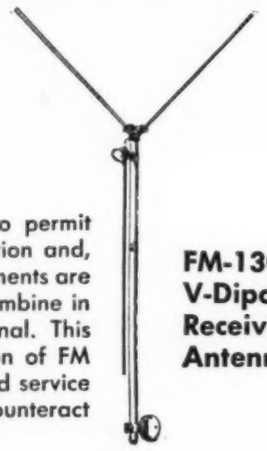
PREMAX

FM-130 "Highly Satisfactory" Says FM Broadcast Station . . .

Eliminates Noise In Reception. Low Cost

V Dipole Type Proving Popular In Installations

A Chief Engineer reports: "... set up several unfavorable locations where man-made electrical noises abounded, and we found that the 3d dimensional adjustment in the dipole arms helped considerably to reduce noises..."



FM-130 V-Dipole Receiving Antenna

Premax V Dipole Antennas are designed to permit adjustment of the angle for strongest reception and, when the proper vertical or horizontal adjustments are made the "direct" and "reflected" signals combine in phase, thereby increasing the received signal. This type of Antenna will insure proper reception of FM Signals and is being adopted by dealers and service men who have been seeking some way to counteract man-made electrical noise in receiving sets.

Write for special Bulletin FMT-148, telling why an Adjustable V Antenna is best for FM and TV.

Premax Products

Div. Chisholm-Ryder Co., Inc.
4813 Highland Ave. Niagara Falls, N. Y.

RADIO TUBES

For immediate shipment
R.M.A. Guaranteed
Below Distributor Costs
Individually Sealed Cartons

Type	Price
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12SA7GT	.46
12SQ7GT	.46
12SK7GT	.46
12SJ7GT	.46
35L6GT	.40
35Z5GT	.32
50L6GT	.46

25% DEPOSIT REQUIRED ON C.O.D.
10% DISCOUNT ON LOTS OF 50 OR MORE
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RAVAC ELECTRONICS CORP.
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SAVE at R. P. D.

Close Out Materials

SPECIALS IN TUBES — BULK PACK

5U4G	ea. 45c	Lots of 10	$3.90
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Thordarson Choke T74G29 15 Hy 150 Ma 200 Ohm DC upright mtg. ..... Each $1.97
Jefferson Elect. Sealed Filter Choke 40 Ma 20 Hy Size 2x2½x2¾ ..... Each .79

FRACTIONAL MOTORS

Compound Wound 115 V DC 3/16 H.P. Input 115 V DC—3/16 H.P. 2 amp. (18 Pds) 3450 R.P.M. Oil Impregnated Ball Bearings. Each $3.69; 4 to case $14.00

3" Triplett O-500 DC Micro ampere meters. Special each $4.69
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Centralab 500,000 K Control No. 1 taper, ½" Shaft, ea. 19c; 10 for $1.50
Little fuse 3AG—2 amp 250 Volt fuses. 50 for $1.00; 100 for 1.50
3AG—10 amp 250 Volt fuses. 50 for $3.00; 100 for 5.00
Buss Fuse Holders for 3AG Fuses. Each 15c; 10 for 1.25
Bathtub Cond. 1.0 mfd 100 Volt. Each 9c; Lots of 25 ..... 1.25
5000 Ohm Controls with Switch. Each 35c; Lots of 10 ..... 3.00

HARDWARE

Asst. Screws, nuts, washers, rivets, solder lugs, springs and 1000 other useful parts. 5 pounds for $1.49

G.E. Pyronol Capacitors 23F47-2 mfd 4000 V D.C. Each $4.79
Amphenal 2 Pole Receptacle MIP61F. Each 10c; Lots of 25 ..... 2.00
Amphenal 2 Pole Plug 61M4. Each 12c; Lots of 25 ..... 2.50
Pickup Arms Astatic D9 with L26 Cartridge. Each $2.29; 5 for 9.85
Tobe Filtermite 4 Prong Plug in Type 8-8 mfd 600 Volt. Each 89c
Slide Switches DPDT. Each 18c; Lots of 100. $15.00

FREE! Write for R.P.D.'s latest bulletin for more sensational values.

Terms: Remittance with order PLUS POSTAGE or 25% deposit, balance C.O.D.

RADIO PARTS DISTRIBUTORS
925 E. 55th St., Chicago 15, Ill.

at an unvarying speed. Three separate motors are used in these machines.

Additional information on these recorders may be obtained by writing to *Amplifier Corp. of America*, 396-398 Broadway, New York 13, New York.

NEW VARIAC LINE

General Radio Company has just released a new folder covering the company's line of "Variacs."

This bulletin describes several new models and introduces the V-10 series. This is a new intermediate size with a load rating of 1.725 kva. on 115 volt lines and 1.15 kva. on 230 volt lines. The 115 volt models of the V-10 are rated at 10 amperes with a 15 ampere maximum. This maximum rating coincides with the capacity of outlets, plugs, cords and No. 14 wire circuits ordinarily found in the laboratory and in the home.

Further information on these "Variacs" may be obtained by writing to *General Radio Company*, 275 Massachusetts Avenue, Cambridge 39, Mass. for a copy of the new folder.

1948 FEDERALOG

Federal Electric Products Company, has just released the latest edition of the "Federalog." This catalogue contains information on the complete *Federal* line.

Featured in the catalogue are the company's newest motor controls, safety switches, service equipment, circuit breakers, panelboards, switchboards, and bus duct.

Copies of this catalogue may be obtained by writing to *Federal Electric Products Company*, 50 Paris Street, Newark 5, New Jersey.

NEW AM-FM LINE

Radio Wire Television Inc., has just issued a flyer featuring FM and AM radio sets in the low-price field. Also featured is a low-cost FM-AM tuner with an automatic frequency control circuit (a radar development) to keep FM at optimum tuning without manual readjustment.

For the serviceman, ham, and hobbyist, there are hundreds of replacement parts, sets, and kits ranging from standard resistors and capacitors to NBFM and television components. Space is also devoted to a complete line of amplifiers and accessories with power capacities ranging from 1 to 75 watts.

Television kits incorporating large size picture tubes are available as well as a new adjustable magnifier lens that triples the area of 7" pictures. For the devotee of high quality, combination-type 15" speakers, magnetic pickups, and console FM-AM installation are given substantial coverage.

This flyer, C-41, is free upon request by writing to *Radio Wire Television Inc.*, 100 Sixth Avenue, New York, New York.

PRECISION INSTRUMENTS

A new catalogue compiled by *Associated Research, Incorporated* has recently been released containing a wide range of precision instruments for industry and utility.

In this catalogue is information and engineering data on insulation and ground resistance testing, and insulation breakdown testing.

Other instruments shown include ohmmeters, ammeters, soil resistivity meters, limits bridges, transformers, and tachometers. The Keeler Polygraph (known as the "Lie Detector") is also described and engineering service representatives are listed.

Associated Research, Incorporated, 231 S. Green Street, Chicago 7, Ill. will furnish a copy of the catalogue upon request.

INSTRUMENTS CATALOGUE

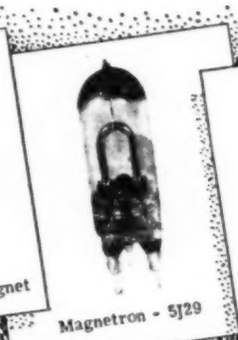
Electro-Tech Equipment Company has

Now *is your* OPPORTUNITY TO BUY TUBES *at Ridiculously Low Prices*

Transmitting - Special Purpose

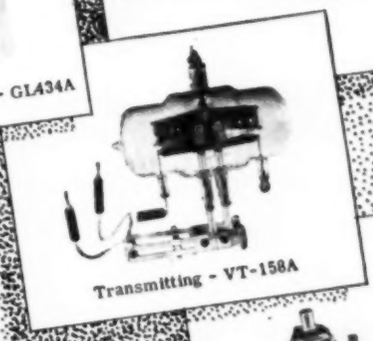
Every tube is *Brand New* in original unbroken factory package

Magnetron - 2J38 w/magnet

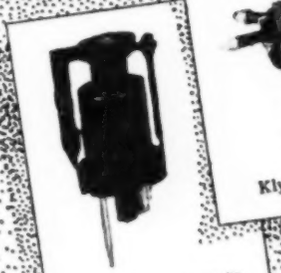

Magnetron - 5J29

Rectifier - 250R

Transmitting - GL434A


Transmitting - VT-158A

Klystron - 417A


Klystron - 723A/B

Magnetrons

2J22	$ 15.00
2J38 w/magnet	15.95
2J48	15.95
4J26	15.95
5J23	15.95
5J29	15.95
714AY	9.80
725A	12.50

Cathode Ray

3CP1/S1	$ .95
5AP1	2.49
5JP2	3.95
12GP7	12.50

Receiving

VT-25A	(Special 10) .69
VT-52	(Special 45) .69
6J6	Twin Triode .69
717A	(6AK5 w/octal base) .98
9002	Miniature UHF Triode .95

Special Purpose

1B24	T-R Tube 2.95
724B	Spark Gap Tube 1.95
2051	Thyratron .49
"	" (in lots of 100) ea .35
VR-150	Voltage Regulator .69
6AMP	Tungar Rectifier 3.00

Klystrons

417A	$9.80
723A/B	3.95
726A	4.75

Rectifiers

CRP-72	$2.95
250R	4.95
WL531	29.95
866A/866	.98
WL869B	29.95
1641/RK60	.69

Transmitting

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24G	UHF Triode. Plate Diss. 25W. 2000V at 75 ma. good up to 300 Mc. .69
VT-158A.	UHF Triode with Tuned Circuits Built-in 4.90
388A	Door Knob Triode. 4.95
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GL446A	Lighthouse (2C40) .74
WL530	Water Cooled Triode .39.50
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804	Pentode 3.75
807	Beam Power Tetrode 1.19
813	Beam Power Tetrode 6.95
829	Beam Power Tetrode 2.95
841	Triode .69
1625	Beam Power Tetrode .49
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7193	UHF Triode .39
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TERMS - Orders under $3.00, cash with order; orders over $3.00 require 20% deposit, balance C.O.D.

ALL PRICES ARE NET, F.O.B. DAYTON, O.

Everything in Electronics

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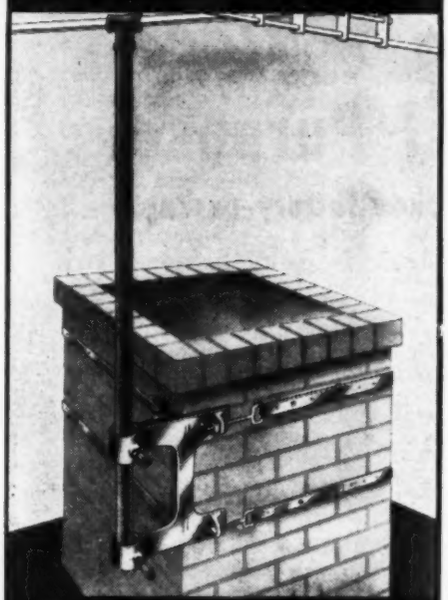
STANDARD RADIO & ELECTRONIC PRODUCTS CO.
135 E SECOND ST DAYTON 2, OHIO

Don't Delay - Order Today!

New! New!

CHIMNEY MOUNT ANTENNA BASE

• for TELEVISION • FM • AMATEURS



INSTALLED IN 10 MINUTES PERMITS USE OF SEVERAL MOUNTS ON ONE CHIMNEY

"Chimney Mount" is a brilliantly engineered new antenna base that can be installed in 10 minutes without the use of special tools or drilling of holes. Several can be strapped to one chimney — also mounts on pole, 2 x 4, side of house or to any rectangular roof extension. Fastens aerial to highest point with galvanized steel bands having a combined tensile strength of more than 3,000 pounds. Made of corrosion-resistant aircraft-type aluminum alloy. Weight: 3 lbs.

"Chimney Mount"
List Price, $7.50
Pat. **Cost to Trade, $4.50** Pending

Available Through All Leading Jobbers or Write to:

South River Metal Products Co.
South River, New Jersey

made available a 66 page catalogue containing a comprehensive coverage of all standard makes of instruments and controls.

In addition to its illustrations, this catalogue also gives data, specifications, and prices on a vast number of items needed by manufacturers and industry in general for control purposes. One page is given over to suggestions on the purchase and use of instruments together with charts illustrating conventional instrument connections.

Included in this book are tables and connection diagrams on rectifiers, variable voltage transformers, etc. There are also sections on portable and laboratory standard instruments, panel and switchboard meters, electrical and electronic service instruments, oscilloscopes, variable and constant voltage transformers, rectifiers, pyrometer and temperature controllers, rheostats, relays and miscellaneous measuring and control equipment. This catalogue can be obtained by writing to the *Electro-Tech Equipment Company*, 117 Lafayette Street, New York 13, New York.

ELECTRIC MICROMETER

Stevens-Arnold Inc. has released information on the Type 156 Electric Micrometer in their new catalogue sheet.

This electric micrometer is a dual purpose instrument. It can perform the usual measuring and gauging operations and it is also suitable for telemetering where remote indications of small movements are wanted.

The micrometer is arranged for battery operation and consists of a transmitter unit and a control unit together with connecting cable.

The transmitter is a sealed unit having a projection plunger which will accept motions of .010" from the center position, or 020" total in one direction. This mechanical motion is translated, inside the housing, into changes in electrical energy which are sent to the control unit.

Further information on this micrometer may be obtained from *Stevens-Arnold Inc.*, 22 Elkins Street, South Boston 27, Mass. Ask for catalogue sheet 227.

CARBON-GRAPHITE SPECIALTIES

The *Stackpole Carbon Company* has compiled a booklet on the numerous carbon and graphite specialties which they produce. Interesting engineering and production data are given in this 44 page booklet.

Of particular interest is a section devoted to analyzing the physical and electrical properties of carbon and graphite in relation to their applications over a broad industrial front.

Included among the many items discussed are tube anodes, battery carbons, ground rods, electrical contacts, carbon piles (voltage regulator discs), chemical carbons, trolley and pantograph shoes, water heater and pasteurization electrodes, seal rings, friction segments, clutch rings, bearing materials, brazing and welding carbon supplies, resistance welding tips, carbon molds and dies, spectrographite, and many others.

This booklet may be obtained free upon request by writing to the *Stackpole Carbon Company*, St. Marys, Pa., and asking for the "*Stackpole* Carbon Specialties Booklet" on your company letterhead.

—30—

360 Watt Transmitter

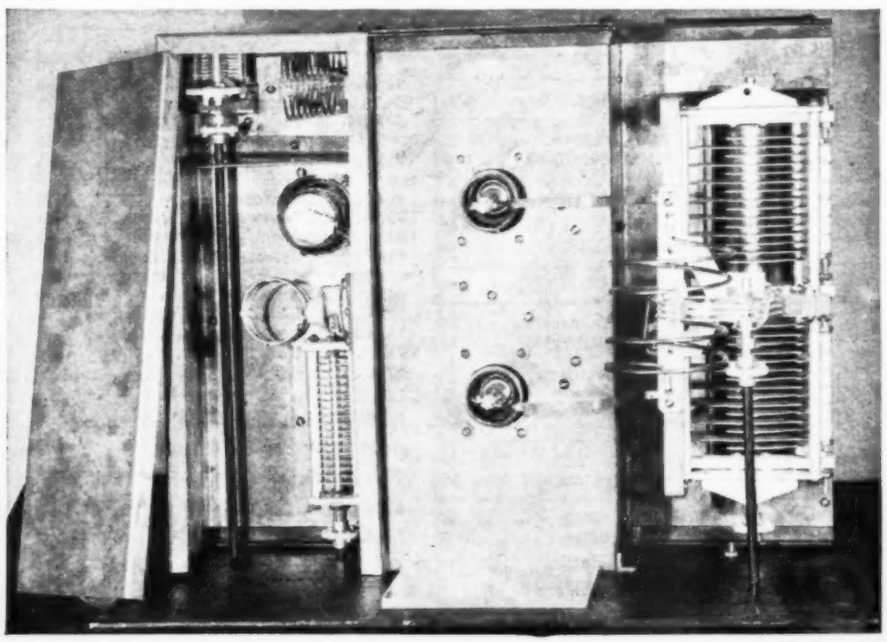
(*Continued from page* 71)

fier. Above at right is a variable coupling adjustment. In the center at the top is a circular lucite window for visual inspection of the tubes during operation. When properly loaded the 3D24's operate with dull red plates. The inspection window allows the operator to determine, by the color of the plates, when the tubes are properly balanced.

The transmitter is used with a 10 meter three-element beam of the "Plumbers' Delight" variety and on 20 meters with a half-wave horizontal dipole running in a north-south direction. During the first week of operation, WAC was worked on 10 and 20 meters c.w. Using NBFM on 10 and 20 meters, Europe, South America, Australia, and South Africa have been contacted. In all cases reports were as good as those received when operating the old standby transmitter which normally operates at 450 watts input both c.w. and phone.

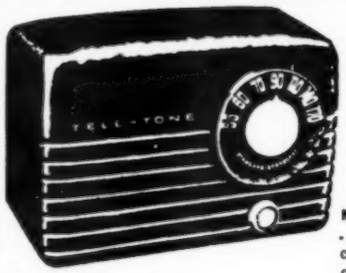
—30—

Fig. 7. Looking down on the final amplifier. The two tubes peeking through are the 3D24's. The 807 buffer is in section shown with the cover off.



IRVING JOSEPH-WHERE PRICE IS AN OBJECT

AND QUALITY IS UNDERSTOOD-EVERY ITEM WE SHIP IS BACKED BY AN **UNCONDITIONAL GUARANTEE**



NEW FOR 1948
NOT SINCE 1939

A Full Powered Superheterodyne Radio

TELETONE

Model No. 165—Styled for tomorrow . . . powered for sharp, clear, reception. A wondrously toned superhet circuit. In practically unbreakable plastic cabinet. **$9.95**
For Only .....

Amazing!
Here's the EXTRA Radio You Need For—Kitchen, Bedside Use, Playroom

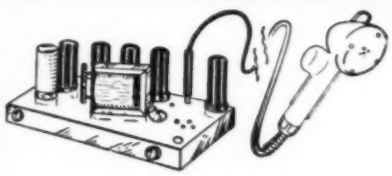
MODEL 175
Same as 165 in ivory..... **$12.95**

MODEL 159
5 TUBE AC-DC
TABLE MODEL

Walnut **$19.95**
Ivory **22.95**

MODEL 166
5 TUBE SUPERHETERODYNE
WITH HANDLE

Ivory only **$16.95**



HI-FI UTILITY AMPLIFIER KIT

PUT YOUR T-17-B (CARBON MIKE) TO WORK!!

Utility amplifier will take a lot of kicking around while giving you these important "big amplifier" features.

1. Voltage doubling circuit. Uses two 100 MA Selenium Rectifiers.
2. Full 6 Watt Power Output.
3. Hi-Fi response, 50-20,000 C.P.S.
4. Inverse feed back for finer quality.
5. Push pull balanced output. Heavy duty universal output transformer.
6. Uses most efficient beam power output tube available. (12A6) 12.6V—150 MA filament. Power output rated at 250V, 6W.
7. Bass Boost.
8. Excellent for use with phono, F. M. Tuner or Crystal mike.

Rugged simplicity, inexpensiveness and extreme versatility make this unit a must for every radio man, beginner or professional.

Complete Kit, less Mike and Speaker..... **$9.50**

Same As Above, 3W output less voltage doubling circuit **$6.50**

Each kit contains **all necessary components,** including 5 tubes, diagrams and pictorials, selenium rectifiers, resistors, condensers, etc., etc.

25 POUNDS OF RADIO PARTS AND ASSEMBLIES

We are swamped with tons of samples and odds and ends which canot be placed in our regular stock. We must dispose of this useful merchandise immediately to give us elbow room. Buy 25 pounds of parts and assemblies at the ridiculously low price of

$3.00

600V PAPER TUBULAR BY-PASS CONDENSERS

Wax impregnated. Mfg. by John E. Fast.

.001	12c
.002	12c
.005	12c
.01	12c
.02	12c
.05	15c
.1	18c

Freshness Guaranteed
BUFFER CONDENSERS

.005—2000V	20c ea.
.0075—2000V	20c ea.
.01—2000V	20c ea.

TRIMMER CONDENSER
275-550 mmfd. For broadcast band application.
10 for 80c

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1LN5	1.10	6SK7	.50	35Z5	.60
1N5	.60	6SL7	.75	39/44	.50
1R5	.75	6SN7	.60	50B5	.60
1S5	.75	6SQ7	.50	50L6	.60
1T4	.75	6SR7	.50	75	.50
3Q5	.75	6V6	.60	76	.50
5U4	.50	6X5	.75	77	.50
5Y3	.50	12AT6	.50	78	.50
6AC7	1.10	12BA6	.60	80	.50
6AG5	1.10	12BE6	.60	84/6Z4	.50
6C4	.50	12J5	.50	117L7	1.10
6C5	.50	12SF7	.50	954	.75
6H6	.50	12SG7	.60	955	.75
6J5	.50	12SJ7	.50	956	.75
6J6	.50	12SK7	.60	9001	.50
6K6	.50	12SN7	.50		
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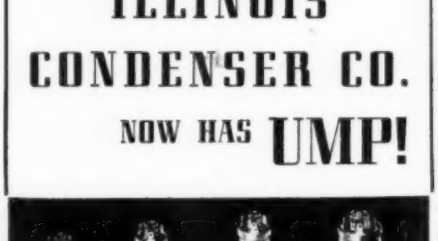

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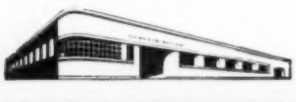

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S & S RADIO **Rochelle, Georgia**
Phones 403 and 5101 (nite)

The Inductuner

(*Continued from page* 62)

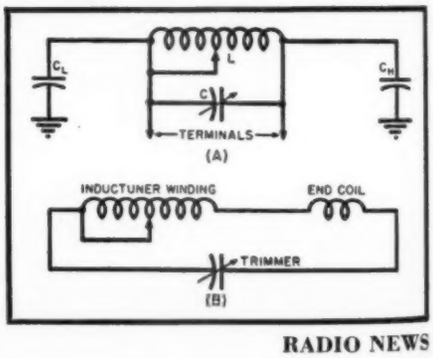
the movement of the trolley to only a certain portion of the unit.

Now, it is entirely possible to attach a small condenser across each inductance and use the trolley to tune the coil over whatever range is desired. However, better results can be obtained if an end inductance having a high Q is connected to the "Inductuner" coil and this is employed to determine the highest frequency of the unit. See Fig. 3B. By the addition of this fixed coil, we can obtain a better Q characteristic than if the variable coil were run out to the limit in order to reach the highest frequency. By adding the coil, the trolley is run as far as it is desired to go, and whatever remains on the "Inductuner" unit plus the added end inductance gives the highest frequency of the tuning range. With proper design, it is possible to produce a rising Q with frequency, which is highly desirable in view of the poorer over-all performance of receivers at the high frequency end of the band.

The use of the "Inductuner" in *DuMont* television receivers is illustrated in Fig. 2. The input circuit leading to the antenna transmission line is an unbalanced arrangement with an impedance of 72 ohms. The signal is received in the cathode leg of the r.f. amplifier, because the tube is being operated as a grounded-grid amplifier with both triode sections connected in parallel. The signal output of the 6J6 r.f. amplifier is transferred to the mixer via the complex coupling network of L_1, L_2a, C_1, C_2, C_3, L_3 and L_2b. L_2a and L_2b are two sections of the three-section "Inductuner." L_1 and L_3 are end coils, inserted in series with the "Inductuner" windings for the reasons previously given. The third winding of the "Inductuner" is employed in the oscillator, together with an end coil, L_4, a shunt coil, L_5, and a shunt condenser, C_4. The shunt coil is required because the oscillator frequency is higher than the incoming signal frequency by an amount equal to the i.f. The oscillator, incidentally, is one of the ultraudion variety.

The variable trimmer condensers C_1, C_2, and C_3 permit adjustments to be made in order to adjust the coupling

Fig. 3. (A) Equivalent electrical circuit of the "Inductuner". (B) Adding an end coil to the "Inductuner" often provides better high frequency characteristics.



network for a 6.0 mc. bandpass. In the oscillator, C_4 is adjusted to permit the oscillator to track over the band. A photograph of the complete r.f. section of the receiver, assembled with the "Inductuner," is shown in Fig. 1.

—30—

Grid Dip Oscillator

(*Continued from page* 57)

series resistor. The tube is mounted on the outside for convenience, but could just as well be mounted inside the case, if the case is made correspondingly larger. The "penlite" cell is mounted on the inside of the side cover by means of two standard cartridge fuse clips. The paper covering is removed from the battery so that the clips form the ground connection. A wire is soldered to the positive terminal of the battery and connects to the push-button switch. Wires are also soldered to the terminals of the plate supply battery. These wires are left long enough to permit easy replacement of the battery when necessary. The life of the "penlite" filament battery and the "minimax" plate battery apparently will be very good, as the original batteries are still in good condition after over six months of use.

The coils used with this instrument are wound on forms obtained from war surplus supplies. These forms are ¾" in diameter and 1⅝" long, with tapped holes in each end spaced ½" apart. They are ideal for this purpose. Any similar form may be used, and the plug-in mountings arranged accordingly. It is advisable to use a coil of similar proportions for this purpose, preferably not over 1" in diameter. The winding data for the coils used is included in the parts list.

When the instrument is finished, the coils may be easily calibrated with a receiver, using the grid dip oscillator as a heterodyne frequency meter. Care should be exercised when using a receiver having only one stage of r.f. amplification, lest the image be confused with the true frequency. Some receivers have very little image rejection to strong signals and errors may result. It is best to reduce the gain of the receiver until the "S" meter reading is approximately one-half of full scale reading, and be sure to record only the signal having the highest response when two or more responses are noted, close together in frequency.

Once having built a satisfactory grid dip oscillator, it will be found almost indispensable. It will enable you to properly adjust tuned circuits in a transmitter or receiver during construction instead of later. It will enable you to find spurious resonances in r.f. chokes and wiring that may otherwise be very difficult to locate. It is handy to carry up to the antenna for preliminary tuning of the elements without power from the transmitter. It is a handy heterodyne frequency meter for rough checking. If a snap switch is installed to disconnect the "B" battery,

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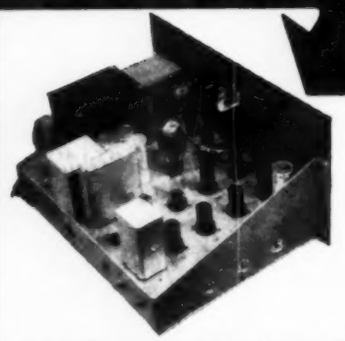

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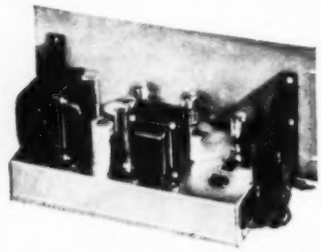

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—30—

Pigeon Catcher

(*Continued from page* 50)

(F_1 and F_2) are shown in Fig. 9.

A phased array that has shown exceptional results is shown in schematic form in Fig. 8. This may well be called a twin-three or two colinear, three-element beam. A ten-meter version is the same size as a twenty-meter, three-element beam of conventional design. The radiator is two half-waves in phase and each half-wave has its own reflector and director. The adjusting stubs may be arranged so that they come near the center of the support pole, and the shorting bars adjusted without recourse to a sky hook. Such a beam was once tried on the same pole that later held the "Pigeon Catcher." With only 18 watts input some rare DX was worked on 10-meter phone. We did not get a chance to try high power on the twin-three or lower power on the "Pigeon Catcher." Both are now torn down and we may never know which is the better.

Our sincere thanks go to Charles McLaughlin, W7FLY, for his help on our various antenna brainstorms.

—30—

A NOVEL TWO-TUBE "PICNIC PORTABLE"

By GLENN A. MARSH

MOST experimenters will have many of the parts needed to build this simple little set. By virtue of a loop antenna it is completely portable and in spite of the fact that it uses only two tubes gives plenty of loudspeaker volume on local stations. Even though a regenerative detector is used there is no hissing or howling, and the selectivity is as good as that of a superhet.

The circuit is shown in Fig. 1. The original model was built on a 6 x 4 inch chassis but almost any layout should work well. Hence the chassis should be chosen to fit into an available case or box. The only critical dimension was found to be the distance from the antenna loop to the chassis. Standoff insulators should support the antenna at least 1¼ inches away from the chassis.

The regeneration was found to depend upon the value of R_2, and the value given (50,000 ohms) yielded the best results.

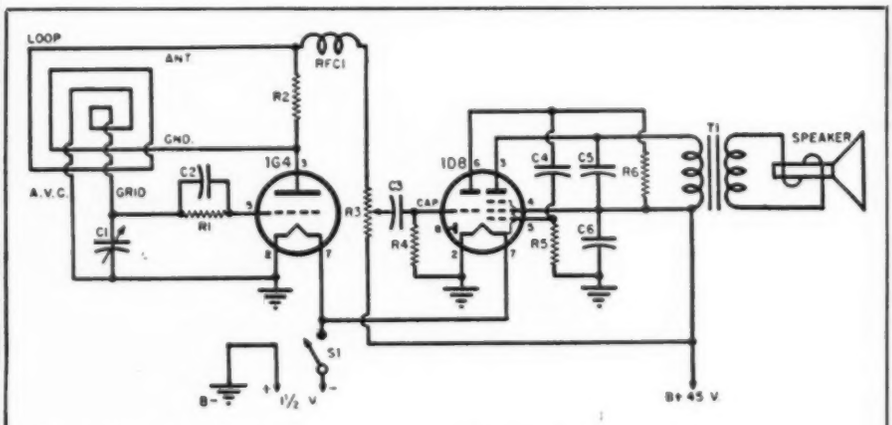
Two flashlight batteries in parallel serve as the "A" supply, and a small 45 volt hearing aid battery may be used for the "B" battery. The "B" drain is only 6.5 ma.; with normal use the battery will last 60 to 80 hours. Ninety volts may be used as the "B" supply for stronger volume on weak and distant stations, if desired. It is also possible to increase the sensitivity by connecting a 20 foot wire to the grid terminal of the loop antenna, although this sacrifices the portability.

Notice that there are no coils to wind and nothing to align. In this sense this is probably the most easily constructed loudspeaker portable to be reported.

We are perhaps cheating a little by calling this a two tube set when actually one of the tubes, the 1D8GT, is used as a triode a.f. amplifier and as a power output pentode. Be that as it may, for sensitivity, selectivity and simple construction, this "picnic portable" will be hard to beat.

—30—

Fig. 1. Schematic diagram of two-tube portable receiver. Resister, R_2, is shown as a fixed unit. Since this is the regeneration control, it may be advisable to use a potentiometer instead. If a 90 volt "B" supply is used, it will be necessary to make some changes in component values. Condensers C_3, C_4, and C_5 should be 400 v. units. Condenser C_6 should be of 150 w.v. rating. The output transformer should then be matched at 12,000 ohms to voice coil.



R_1, R_5—2.2 megohm, ½ w. res.
R_2—50,000 ohm, ½ w. res.
R_3—100,000 ohm pot. (with sw.)
R_4—1 megohm, ½ w. res.
R_6—250,000 ohm, ½ w. res.
C_1—350-500 mmfd. var. cond.
C_2—250 mmfd. mica cond.
C_3, C_4, C_5—.001 mfd., 200 v. cond.
C_6—5 mfd., 50 v. elec. cond.
S_1—S.p.s.t. sw. (on R_3)
T_1—Output trans., 20,000 ohms to v.c.
Speaker—3" PM type
Loop—Any conventional loop antenna
RFC1—2.5 mh. r.f. choke
1—1G4 tube
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up to 36v A.C.	up to	28v D.C.	10 Amp.	12.45
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8mfd.	600v	1.10	.25mfd.	2500v	1.45
10mfd.	600v	1.15	.5mfd.	2500v	1.75
2X.1mfd.	1000v	.45	.05mfd.	3000v	1.95
.25mfd.	1000v	.45	.1mfd.	3000v	2.25
1mfd.	1000v	.60	.25mfd.	3000v	2.65
2mfd.	1000v	.70	.5mfd.	3000v	2.85
4mfd.	1000v	.90	1mfd.	3000v	3.50
8mfd.	1000v	1.95	12mfd.	3000v	6.95
10mfd.	1000v	2.10	2mfd.	4000v	5.95
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VR150	.75	1654	1.98
100TH	12.95	9001	1.15
100TS	3.00	9002	.98
211	1.25	9003	.98
75T	2.95	9004	.98
250TH	17.50	9005	.98
257B	6.49	9006	.98
304TH	9.95	F-128A	75.00

GLIDE PATH RECEIVER R-89/ARN-5

Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7—6A15, 1—12SR7, 2—12SN7, 1—28D7, and including three crystals 6497KC, 6522K.

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1600v @ 4 ma.; 700v CT @ 150 ma.; 6.3v @ 9A	8.50
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385-0-385-550 @ 200 ma.; 2½v @ 2A; 5v @ 3A; 3x6.3v @ 6A—PRI. 110/220	9.95
350-0-350v @ 150 ma., 5v @ 3A; 6.3v @ 7.5A; 6.3v @ 3A	5.95
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340-0-340v @ 300 ma.; 1540v @ 5 ma.	7.50
335-0-335 @ 60 ma.; 5v @ 3A; 6.3v @ 2A; 0-13-17-21-23v @ 70 ma.—PRI. 110/220	5.49
325-0-325v @ 120 ma.; 10v @ 5A; 5v @ 7A	3.49
300-0-300v @ 65 ma.; 2x5v @ 2A; 6.3v @ 2½A; 6.3v @ 1A	3.49
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6.3v @ 1A; 2½v @ 2A	3.95
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12 hy @ 100ma	1.39	15 hy @ 100ma	1.39
30 hy @ 70ma	1.39	3 hy @ 50ma	.29
120 hy Dual @ 17ma	1.39	30 hy Dual @ 20ma	1.49
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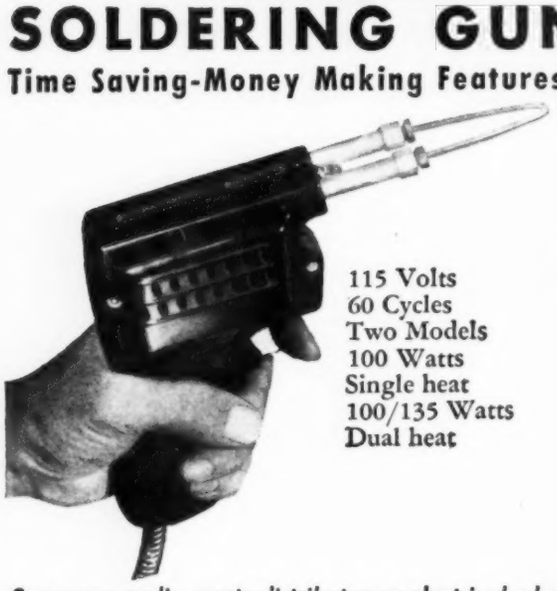

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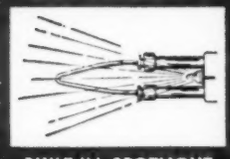

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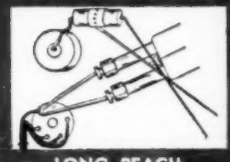

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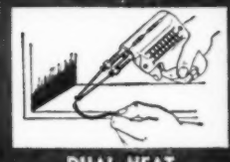

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CIRCUIT FEATURES:—Self-contained power supply for 110V. AC-DC 50-60 cycles . . . Three tube circuit of conventional design, using the latest minature and dual purpose tubes . . . Permeability tuned drift-free I.F's. **COMPACT:** Approximately 4½"x3⅛"x3⅜"

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BC 610 Components . . . Modulator Decks Less modulation transformer. Completely wired..... **$14.95**

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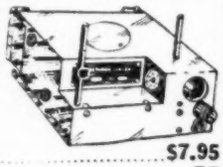
converts BC312 receiver to AC operation. Fits in dynamotor compartment. Also for external use with BC348, 314, 224, and used with BC696 and 459 as ECO. Input 110-120 VAC, 60 cycles. Output 250 VDC @ 95 MA, 12V @ .6 A, 12V CT @ 3A.



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All electrical components for 800VDC @ .200 amp with 117VAC 60 cycle input. .150 amp when used on 25 cycles. 2 Power transformers 800 volts each to be used in series — 2 — 5U4 tubes and sockets, 2 — 10 mfd condensers and 1 — 8 Hy choke. **$14.25**
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International Short-Wave
(Continued from page 72)

missionaries on the staff in Quito as well as many Ecuadorian workers. In the United States there are some 15 additional workers—either on furlough or soon to come to Ecuador for the first time.

Languages have increased from the original Spanish and Quechua (the most cultured of all, the linguistic stocks of South America, which at one time was spoken by an unbroken chain of tribes for nearly two thousand miles from north to south), to the 18 languages now employed (with others to be added soon).

"We are at present looking for new property since we are badly crowded in our present location," Mr. Howard explains. "It is our hope to be able to increase our power so as to get out even better. Rotary beam antennas are used on all short-wave frequencies although only the 15.115 and 12.455 antennas are regularly turned. We also operate a surplus Army SCR-299 radio bus with public address equipment, transmitter, receivers, and a 10-kw. portable power unit. This makes possible many types of remote broadcasts and special events, as well as publicity work.

Since HCJB is missionary-operated and owned, programs given the greatest emphasis are naturally religious ones. Many of the best known Gospel programs from the United States are carried—such as "The Old Fashioned Revival Hour", "Haven of Rest", "Young People's Church of the Air", "Lutheran Hour", "Back to the Bible", "Radio Bible Class", "Miracles and Melodies", "Word of Life Hour", and many others. More than 700 Gospel programs are aired monthly.

HCJB is also the Quito outlet of the *Cadena Panamericana* of the National Broadcasting Company (USA), and as such has carried hundreds of rebroadcasts of Spanish programs from New York. Particularly during World War II, many *"Goodwill"* programs are rebroadcast.

Although religious programs take preeminence, many cultural and educational programs are presented as well.

The fact that HCJB broadcasts are heard well around the world is proved by the thousands of letters which reach the station from listeners in practically every corner of the universe.

"Quito is a city of some 220,000 people," Mr. Howard points out, "and is located at an elevation of some 9500 feet in the heart of the Andes mountains, about 12 miles south of the equator. On a clear day one can see some seven snow-capped peaks from the city, really a wonderful sight to behold. The

weather is just about ideal, with the temperature averaging 60 to 65 degrees F. every day of the year. Corresponding to winter in the United States, we have our rainy season when it usually rains in the afternoon but is sunny and nice in the morning. Corresponding to summer in the States, we have a dry season when it seldom rains at all. Quito has often been called 'the land of Eternal Spring,' and Ecuador is often termed 'the Switzerland of South America'.

"Our relationship with the Ecuador Government has been very cordial through the years," Mr. Howard continues, "and they have often gone out of their way to help us. During the past Christmas season when HCJB observed its 16th anniversary, a decoration was received from the Ecuador Government in recognition of the service the station has rendered to the country. This was a decoration of Merit of the *Order of Caballeros,* the highest honor that can be given to an organization of this kind."

Languages used by HCJB include Arabic, Bohemian, Czech, Dutch, *English,* French, German, Greek, Italian, Latvian, Lithuanian, Portuguese, Quechua, Russian, Spanish, Swedish, Urdu, Yiddish, with more languages to be added soon.

Frequencies now in use include 974 kcs. (308 m.), 1 kw.; 5.995 (50 m.), 1 kw.; 9.958 (30 m.), 1 kw.; 12.455 (24 m.), 10 kw., and 15.115 (19 m.), 1 kw. The 15.115 and 12.455 antennas are beamed on (1) London, (2) Omaha, Nebraska, (3) California, and (4) Brazil. The 9.958 and 5.995 outlets are fixed on Omaha, Nebraska. Usually, two or more frequencies are used in parallel.

Normal daily (*Tuesday through Saturday*) schedule is 0530-0900*, 1130-1330, 1600-0000; Sundays, the same and also 1430-1600; on Mondays the station is on *only* 0000-0100, which period is also carried on Wednesdays, Thursdays, Fridays (extends to 0115), Saturdays, and Sundays.

English periods are 0630-0800 (daily), 1630 - 1700 (Saturdays), 1700 - 1800 (daily, 2100 - 2200 (daily), 2200 - 2230 (daily), 2230-2300 (daily), and 2300-0030 (daily); "daily" means *except* Mondays.

HCJB verifies and is glad to receive reports from listeners anywhere in the world. Quito address is P.O. Box 691; offices are maintained at 156 Fifth Avenue, New York 10, New York, USA. It is operated by the World Radio Missionary Fellowship, incorporated in the state of Ohio, USA, in 1931.

As we take our leave of HCJB, *pioneer missionary voice,* we quote this paragraph from "Radio — The New Missionary" (Moody Press, Chicago), by Clarence W.

*(Note: Unless otherwise stated, time herein is expressed in American *EST* on a 24-hour clock basis; *add* 5 hours for GCT. "News" means in the *English* language.)

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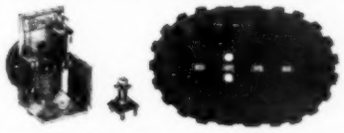

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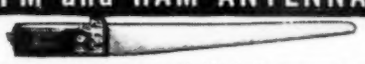

AN-104-B. ¼-wave at 100-156 MC; formerly used with SCR-522, 274-N, ARC-5. A pair make an excellent broad-band dipole for FM reception. Coaxial connector in base. Very sturdy; use anywhere. MA-2153..... 39c

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A—MA-2135. 5-position switch, vol. control & jacks for PL-55 and PL-68. 3" x 4¼" x 2¼". Aluminum finish.

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C—MA-2093. 3-position switch, 2 wired jacks for PL-55 plugs, internal jack strip, circuit diagram. 3" x 3⅝" x 1¾" Aluminum finish.

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E—MA-2092. 4-position switch. 2½" x 2¼" x 1⅜". Aluminum finish.

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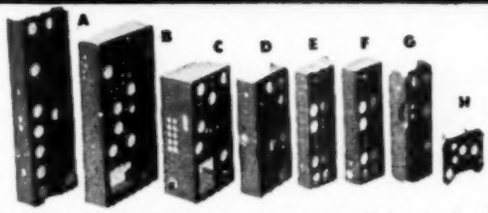

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(D) MA-2914 10"x5"x2" 6 tube . . . . . 39¢
(E) MA-2907 10¼"x3⅝" x 1½" 6 tube . . . 29¢
(F) MA-2911 10¼"x3½" x 1⅝" 7 tube . . . 29¢
(G) MA-2912 10" x 3½"x 2" 5 tube . . . . . 29¢ (for chassis lock sockets)
(H) MA-2915 5⅜"x 1⅜" 3 tube . . . . . 15¢

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Get your share of this fine-quality coaxial cable. Solid, moisture-proof polyethylene dielectric; fully shielded. 52 ohms nominal impedance. Not sold in less than 100 foot lengths. MA-5018 per 100 feet . . . $2.89

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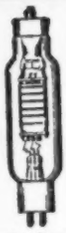

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2050 Negative-control, heater-cathode type. Can be operated directly from a high-vacuum phototube. Octal 8-pin base. **69c** ea.

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Jones, one of the founders and co-directors of the station:

"God's bringing to pass that dream and hope which He had implanted makes up the remarkable story of spiritual romance that constitutes the day-by-day progress of Radio Station HCJB since its inception. *Here is a promise and a method transformed into a missionary radio station, flashing the good news to the 'uttermost parts of the earth'.*"

* * *

Radio War in Orient

We quote some interesting excerpts from an article called *"Radio War For Asia's Ear,"* as reprinted in *Radio Times of India*, and which originally appeared in *The Sunday News of India*. The author, Arthur Fay, wrote:

"A radio war is going on in the Far East and will be intensified as Britain, America, France, Holland, Soviet Russia, China, and other nations build more powerful transmitters to help them to 'win friends and influence people' in the Orient. By the end of next year there will be about 20 transmitters of 100 kilowatts and over putting out entertainment and propaganda designed for Asiatic ears . . . You can get a long-wave radio set for next to nothing in Shanghai these days. But—and this, of course, is why you can get them for next to nothing—nobody wants long-wave sets. The radio dealers who have a lot of them cluttering up their shelves are victims of the wireless war now in full swing in East Asia where many nations are striving for the ear of the Oriental listener. Britain, America, France, Holland, Soviet Russia, and China, too, are in the field with powerful transmitters either operating or planned. India and Pakistan are expected to enter the lists, and Siam and Indonesia have projects of their own.

"Early casualties in the war have been Shanghai's numerous privately-operated stations, closed down because the Chinese Government wants no rivals in its own territories to its State-owned broadcasting service. The drive against

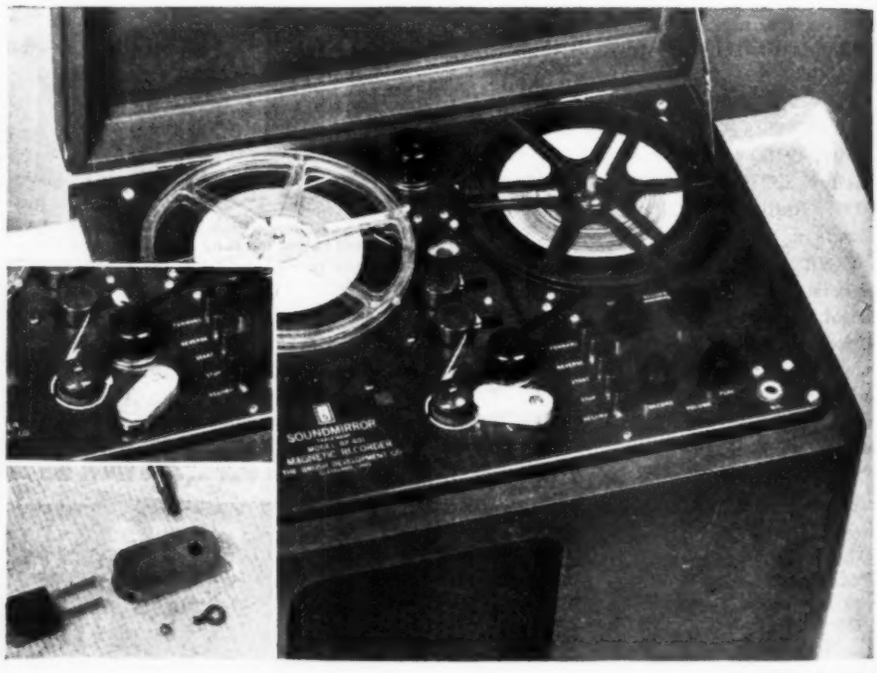
NEW PRESSURE ROLL FOR BRUSH TAPE RECORDER

THE Engineering Department of Minnesota Mining & Manufacturing Company has announced a new pressure roll to be used in conjunction with the Brush "Soundmirror" tape recorder.

According to R. Marchant of the Engineering Department this small pressure roll rides against the surface of the tape on the capstan during operation. A small ball bearing assembly having a ¼ inch face and a ¾ inch o.d. can be mounted on a pivoted arm so as to be held against the capstan by light spring pressure. This arrangement is designed to provide more uniform movement of the tape throughout the entire reel.

In the course of developing a new plastic recording tape for use with the machine, Minnesota Mining & Manufacturing Company found that some machines vary considerably in the amount of spring pressure applied to the felt pads that hold the tape against the recording and erase heads. Since this pressure is quite important it has been suggested that the value be checked by means of a small spring scale. The pad pressure should be about 1¼ ounces on each head. If the machine does not have the proper pressure, the adjustment may be varied by lifting the motor board out of the cabinet.

Top view of Brush "Soundmirror" shows position of new pressure roll.



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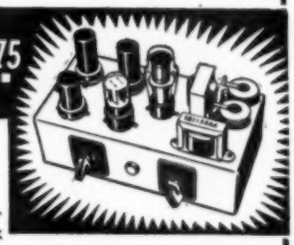

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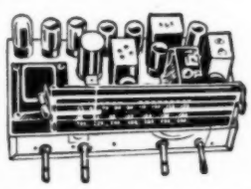

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2x.1	7000 V	4.75	.000067	2500 V	.20
.12	15000 V	6.95	.00007	2500 V	.20
.25	1000 V	.35	.00025	2500 V	.25
.25	4000 V	2.75	.00025	5000 V	.85
.25	6000 V	4.00	.0004	2500 V	.22
10x.25	600 V	1.00	.0005	2500 V	.22
.5	600 V	.28	.00072	5000 V	.89
.5	1000 V	.35	.0008	5000 V	.89
.5	2000 V	.40	.0001	2500 V	.25
.75	2000 V	.55	.0011	5000 V	.89
.77	330 VAC	.35	.002	1200 V	.17
1.0	1000 V	.45	.002	3000 V	.66
2.0	1000 V	.60	.0025	1200 V	.15
4.0	600 V	.60	.00275	2000 V	.28
4.0	1000 V	1.00	.003	2500 V	.30
5.0	220 VAC	.65	.003	3000 V	.66
6.0	600 V	.70	.004	2500 V	.36
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these 'foreign stations' started in January (1947) when a Soviet-subsidized station was raided and 'sealed.' Then the other stations, including a French one, were abolished, to be replaced by the Government-managed XORA. XORA is attacked in the local press for its poor announcing and lack of good musical programs. Both foreigners and educated Chinese prefer to tune in on the short-waves for programs from other lands. And so nobody buys long-wave sets. Shanghai's listeners and Asiatics in general are to have a much wider range of programs to choose from as time goes on.

"Already there is considerable competition among the powers to win friends and influence people among the public-opinion-forming classes who own radio sets and the poorer people who in one way or another get in some group-listening. The United States, with one eye on future trade expansion and another on the threat of Communism, is going for the Eastern listener in a big way and will do so in a bigger way before long. From Los Angeles, New York, Honolulu, Tokyo, and Manila, 'the Voice of America' is heard. Special programs designed for Asiatic ears go out daily putting the U. S. point of view. Now six 250-kilowatt transmitters in Manila are planned to make America's voice still louder in the East.

"Britain has four transmitters operating from Singapore. Five or six more, each of 100 kilowatts and costing between 15,000,000 and 20,000,000 Straits dollars, are to be added. Between 50 and 100 technicians and other staff will look after the new apparatus, which is to go up in South Johore, though the studios will remain in Singapore. The BBC will operate the new station. The use of radio for the education of the young is to be developed in the Malayan Union, schools being provided with standard sets. Asia also hears BBC programs relayed from Australia as well as Australia's own programs.

"Some former Dutch stations are now operated by the Indonesian Republic, but the Netherlands is far from having given up the struggle to put her case in the Far East. She will soon have a 100-kilowatt American-installed transmitter broadcasting from Batavia. France is to modernize her Saigon station, which has many fans outside Indo-China.

"The Chinese Government stations, Chungking, Logan, and Shanghai, and the Communist North Shensi station broadcast daily their own brands of xenophobia along with European and Chinese music and contradictory *communiques* on the civil war. The Communist station, following the Party line, concentrates these days on attacking United States "imperialism." Kuomintang radio propaganda also increasingly

displays a continuously anti-foreign outlook.

"Chiang Kai-shek's Government intends within the next two-an-a-half years to have four powerful short-wave stations, at Shanghai, Chungking, Canton, and Changchun (Manchuria). Besides catering to Chinese nationals, they are to have programs for listeners in Europe, America, and Australia. There is also to be a new high-power station at Nanking.

"Siam is increasing the power of Bangkok Radio with a view to keeping herself before the foreign listener, and India and Pakistan are both in the market for short-wave broadcasting equipment to spread the sound of the rival voices further.

"Soviet broadcasts in every imaginable language are heard throughout the East. But where these broadcasts actually come from even the experts are not sure. There must be a number of stations in the Far Eastern Republic, but exactly where they are is one of the many secrets of this 'forbidden land.' Much of the material is relayed from Moscow, which broadcasts a good deal of material intended for the Asiatic listener. It would seem highly probable, in view of Russian ideas about Asia, that some of the 28 powerful stations which are to be completed by 1950 under the current Five-Year Plan will be located round about Vladivostok, Khabarovsk, and Krasnoyarsk.

"Altogether, by the end of 1949, something like 20 transmitters of 100 kilowatts and over will be directing diverse streams of propaganda, mingled with entertainment and education, at the ears of Eastern Asia."

* * *

Gatti-Hallicrafters Expedition

The Gatti-Hallicrafters Expedition to Africa's Mountains of the Moon has been allotted call letters and wavelengths by the Conference of East African Governors in Nairobi, Kenya Colony, as follows: Uganda, VQ5GHE; Kenya, VQ4EHG (28.3), Uganda (mobile), VQ5HEG, and Tanganyika, VQ3HGE; frequencies assigned are 1.8-2.0 mcs., 7.0-7.2 mcs., 28-30 mcs., and 58.5-60 mcs. At the time this was written, schedule was 0100-1530 EST, using 28.375 (phone) and 28.050 c.w.). The Expedition has been reported widely in the East, contacting U. S. "hams."

The Expedition is combining scientific research and adventure—to test equipment and study radio phenomena at the same time it broadcasts the sounds of the jungle and descriptions of fantastic tribal rituals to thousands of short-wave listeners in the United States and elsewhere. Constant touch is being kept with the outside world by radio as the Expedition makes it way through parts of Tanganyika, Kenya, and Uganda, visiting

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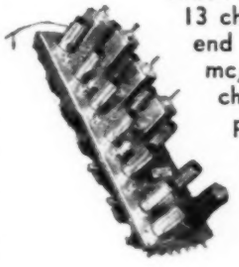
PICTURE IF & SOUND IF STRIP and FRONT END. This sensational picture If & Sound If Strip developed by our engineering staff enables you to build a 10"-12"-15"-20" direct view or projection type receiver with FM sound. Supplied with a 13 channel RF front end unit. The front end covers channels from 44 to 88 mc/s and 174 to 216 mc/s (13 channels). Matched antenna input for 300 ohm line. Tubes: 1-6J6 RF amplifier 1-6J6 converter 1-6J6 oscillator.



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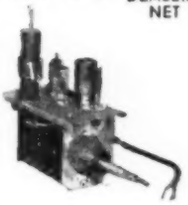

Picture IF band width 4.5 mc/s. All the above circuits and tubes are contained on one chassis. Front end unit on separate chassis. Both picture IF and sound IF delivered completely wired, tested, tubed, and matched ready for use.

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The Dumont Imputuner tunes continuously from 44 to 216 megacycles without a break—covers all 13 television channels as well as FM, amateur, and aviation channels. For ease and convenience of operation no band switching of any kind is required when tuning from channel to channel with the imputuner system. Just one simple operation to reach any desired station.

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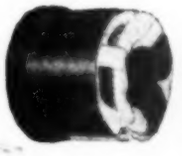

Deflection Yoke similar to RCA part # 20 IDI

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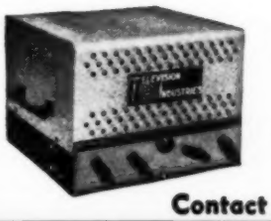

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obscure tribes of pygmies and giant Watussi enroute. At Africa's fabulous Mountains of the Moon, the Expedition is to explore the mysterious Lost Lakes of the Ruwenzori. The legendary Mountains of the Moon lie surrounded by almost impenetrable jungle forest — the *"Fons Nilus"* of the ancients, with snow-clad mountain peaks towering nearly 17,000 feet into the equatorial sky, whose snowfields and glaciers spread over an area of 100 square miles. Present plans call for terminating the Expedition at Nairobi, Kenya Colony.

Sample verification cards, signed by Commander Attilio Gatti, leader of the Expedition, are quite attractive, giving locations as Base Camp, Tanganyika; Base Camp, Uganda, and Base Camp, Kenya.

* * *

Club Notes

New Zealand—All correspondence regarding the New Zealand DX Club should be addressed to 10, Koraha St., Remuera, Auckland, S. E. 2, New Zealand, according to Harold J. Barr, Hon. National Secretary of this group.

Sweden—The Jonkoping - Huskvarna DX-Club has a new name—*Scandinavian DX-Club*, but is still issuing its monthly house organ under the same name, *Nattugglan* (The Night Owl). Officers for 1948 include Karl Ake Bergstrom, president; Aka Hallman, vice-president; Sune Engdahl, secretary; Karl Gustav Frick and Stig Wahrling, cashiers (co-treasurers); Harald Svahn and Rolf Johansson, editorial staff. The club now has over 350 members and is the largest active group in Scandinavia. (Bergstrom, Sweden.)

United States—A unique organization is the *"Silent QRM-ers,"* a group of short-wave listeners banded together for the purpose of exchanging ideas, information, complaints, SWL cards, reports, and so on. Any active short-wave listener is invited to become a member—whether his main interest is amateur fone, c.w. or regular broadcasting station listening. Only requirement is that he is active as a SWL and sends out cards. There is no fee of any kind, "simply because we are not promising anything in return," the organizers point out. "But we think it is a swell way to get acquainted with other SWL's, and to exchange ideas with an objective of improving SWL-ing activities. Anyone interested should write SWL-W2, Walter (Rocky) Hastrich, 19 Holland Ave., Lancaster, New York, for an application blank. Currently, the *'Silent QRM-ers'* are engaged in a 'new member campaign,' trying to build up membership to a respectable figure." (Cooley, Pa.)

* * *

Verification Data

Radio Douala verified for Kary, Pa., in 32 days (airmail both ways). QRA is Radio Douala, Service Radio-electrique, Douala, Cameroun Francais.

QRA of the PZR outlets is Avros Studio, The "Prince Bernhard Transmitter," Paramaribo, Netherlands Guiana. (Southall, Pa.)

The Guatemala stations (TGW series) verify by return mail, cards have been received in less than a week on occasion. (Eyles, Ga.)

YSUA, 6.250, verified promptly by Spanish letter (airmail); announces long-wave call YSU, *Radio Mil Cincuenta* (1050 kcs. which is frequency of medium-wave outlet); power was given as 1 kw.; QRA is Radio Mil Cincuenta, la Avenida Sur No. 50, San Salvador, Republica de Salvador, Central America. (Eyles, Ga.)

Calcutta, 4.840, verifies with prewar type of large QSL card; Bombay, 4.880, verifies with small-type QSL card and letter. (Pearce, England.)

QRA of the Norwegian s.w. outlets is Norsk Rikskringkasting, Oslo, or Norwe-

Potential hams take exam conducted by the XXIV Corps' radio officer, Willard B. Anker (standing at left) at Seoul, Korea. Would-be hams include T/5 Frederick A. Liebold, Memphis, Tenn.; Lt. Col. Elmer F. Estrumse, San Antonio, Texas; Henry Ramirez, Bronx, New York; and Lt. Robert S. Monk, Boise, Idaho, in the usual order.

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HS23A—Used but in A-1 Electrical condition, 8000 ohms impedance. Complete with leather headband. Shpg. Wt. 3 lbs.

ONLY..... **98c**

Type HS-16A—Canvas web headband and long standard type cord. Brand New in original boxes. Shpg. Wt. 3 lbs.

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EXTRA SPECIAL!

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5", 5BPI (Green Screen) and 5 BP4 (White Screen) Surplus C. R. tubes Brand new in original boxes. Get yours while the supply lasts. Shpg. Wt. 5 lbs.

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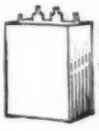

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No. 2785—Dual 12 HY x 250 MA. 150 ohms. DC Res. per section. Shpg. Wt. 17 lbs.

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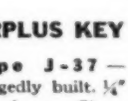

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Shpg. Wt. 1 lb. **12 for 50c**

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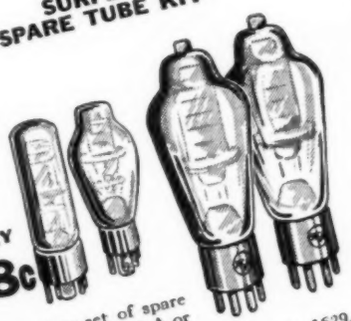
S. B. Carbon Mike with push-to-talk switch on handle. Complete with cord and plug. Brand New—in Original Cartons. Shpg. Wt. 3 lbs.

ONLY **69c**

SURPLUS SPARE TUBE KIT



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Complete set of spare tubes for BC-459-A or similar unit. Consists of 1—1626, 2—1625, and 1—1629. Shpg. Wt. 2 lbs.

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Use this coupon to get Walter Ashe's "Surprise" Trade-In Allowance on your used factory-built test equipment. RNS

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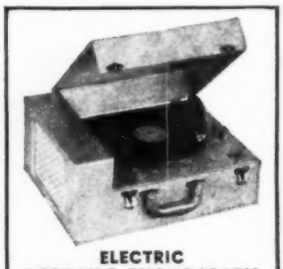
All new tubes. 100% guaranteed. Individually boxed.

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
0Z4	$ .80	6SL7GT	.80	7C5	.60
1A5GT	.54	6SN7GT	.80	7C7	.60
1A7GT	.65	6SQ7	.50	7E6	.60
1H5GT	.54	6SQ7GT	.54	7F7	.60
1LN5	1.10	6SR7	.60	7N7	.60
1N5GT	.65	6U5/6G5	.65	7G7	.60
1R5	.60	6V6GT	.65	7V7	.80
1S4	.60	6X5GT	.45	7Y4	.60
1S5	.60	7A4	.60	7Z4	.60
1T4	.60	7A6	.60	12AT6	.54
3Q4	.60	7A7	.60	12BA6	.54
3Q5GT	.72	7B5	.60	12BE6	.54
3S4	.60	7B6	.60	12A6	.54
5U4G	.45	7B7	.60	12A8GT	.65
5V4G	.72			12C8	.50
5Y3GT	.40			12H6	.54
5Y4G	.45			12J5GT	.45
6A6	.72			12SA7GT	.65
6A7	.65			12SC7	.65
6A8	.60			12SF5	.65
6AC7	.75			12SH7GT	.65
6AK5	.75			12SJ7	.54
6B8G	.72			12SJ7GT	.54
6C4	.50			12SK7GT	.54
6C6	.65			12SL7GT	.80
6C8G	.72			12SN7GT	.54
6E5	.65			12SQ7GT	.54
6F5	.65			12SR7	.54
6F6	.54			14A7/12B7	.60
6F8G	.96			14Q7	.60
6H6	.50			25L6GT	.54
6H6GT	.50			25Z5	.54
6J5	.50			25Z6GT	.54
6J5G	.50			26	.50
6J5GT	.50			27	.45
6J6	.50			35A5	.65
6J7	.60			35L6GT	.54
6K6GT	.45			35W4	.45
6K7	.54			35Y4	.65
6L6	.96			35Z5GT	.45
6L6GA	.96			39/44	.45
6N7	.80			50A5	.65
6R7G	.54			50B5	.54
6SA7GT	.54			50L6GT	.54
6SC7	.65			53	.72
6SF5	.65			70L7GT	.96
6SF7	.65			71A	.65
6SH7GT	.50			77	.54
6SJ7	.50			84/6Z4	.54
6SJ7GT	.50			89	.54
6SK7	.50			117Z6GT	.96
6SK7GT	.50			VR150-30	.70



ELECTRIC PORTABLE PHONOGRAPH

Leatherette Covered, 2 Watt Amplifier. Plays 12 inch records with cover closed. 5 inch Alnico 5 Speaker. Rim drive constant speed. Self starting motor. High fidelity pickup. Size 17"x13"x 7½". List Price $29.95.

NET PRICE $15.95
LOTS OF THREE $14.95

TERMS: 25% with Order—Balance C.O.D.—F.O.B. Chicago

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SENSATIONAL SELLER!

LAKE DELUXE CHANGER

Revolutionizes the Industry! A Sensational Seller!

11 Outstanding Features:

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Dimensions: 13 13/16"W x 12¼"D x 7⅜"H.
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BC-453, BC-454, BC-455: Explanation of control and power circuits and plug terminals. Conversion of the front plug to a local control adapter with volume control, on-off and CW-MCW switch. Schematic for AC power pack. Alignment instructions. Top and bottom views showing parts location. Voltage and resistance readings. Schematic of 3-unit rack, control box, adapters and interconnection.
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Conversion of BC-946-B Broadcast-Band Receiver
Practical wiring diagram. Control circuit explanation. Complete conversion schematic. 106 step-by-step instructions, alignment instructions. Top and bottom views with parts location arrows.
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BC-645, original and conversion, fixed or mobile $1.00
BC-375, conversion to AC, with power supply.. $1.00

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BC-348-J, N, or Q, plus AC Power Pack
BC-348-H, K, L, or R, plus AC Power Pack.
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AN/APN-1, (includes RT-7/APN-1).
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R-65/APN-9 Loran Receiver-Indicator.
EE-8 Field Telephones.

R-5/ARN-7 — AN/APT-2 — RA-10
AN/ARC-4 — AN/APT-5
DZ-1, DZ-2 — BC-1206-C

SCR-269-G (Includes BC-433-G)

PLEASE SPECIFY which you want. Remit with order. **Print** your name and complete address in the upper-left corner of the envelope.

R. E. GOODHEART
2616 N. Spaulding Ave. Chicago 47, Ill.

gian State Broadcasting, Oslo Studios, Oslo, Norway. (Anderson, California.)

Radio Algerie is sending out a QSL card now instead of a letter; QRA given as Radio Algerie, 10 Rue Hoche, Alger, Algerie, Afrique du Nord. (Pearce, England.)

QRA for *Radio Bissau* is CQM, Emissora de Guine, Bissau, Portugues Guine, Africa. (Persson, Sweden.)

EA9AA, 7.080, Tangiers, verified by Spanish letter from Radio Africa, 39 Calle Shakespeare, Tangier, International Zone, Morocco. Report sent in Spanish.

QRA for HLKA is Korean Broadcasting System, 1 Chung Dong Jung, Seoul, Korea, *or* Commanding General, USAMGIK A. G. Personnel, A. P. O. No. 235-2, c/o Postmaster, San Francisco, California,USA. (Kary, Pa.)

Jerusalem QRA of the Near East Arab Broadcasting Station (Jaffa) is Bab Ez Zahira, P. O. Box 1170, Jerusalem, Palestine. (Kary, Pa.)

Address of CS9MB, Azores, is Emissor Regional dos Acores, Avenida Gaspar Fructuoso, Ponta Delgada, S. Miquel, Acores. (Kary, Pa.)

For those who do not already have it, QRA of *Radio Damascus* is Posts, Telegraphs, and Telephones Dept., Syrian Republic, Damascus, Syria (Syrie).

Radio Club de Tenerife can be addressed as Estaciones EAJ-43 y EA8AB, Apartado de Correos 225, Santa Cruz de Tenerife, Islas Canarias. (Kary, Pa.)

* * *

This Month's Schedules

(NOTE: *Between the time this was compiled and now, some stations will have gone on Summer Time — making their transmissions one hour earlier than listed herein.*— K.R.B.)

Anglo-Egyptian Sudan—Radio Omdurman operates on 13.320, 9.650, and 572 kcs., with powers of 250 w., 350 w., and 750 w., respectively; is scheduled in Arabic daily 2315-2345, and *except* Friday at 1130-1300, 1400-1930; on Fridays in Arabic at 1130-120, 1400-1430, and also has transmissions at 0300-0430, 0900-1000; on Fridays between 1230-1300 has *English* period. (Persson, Sweden.)

Argentina — LRY is back on 9.545. (Beck, N.Y.) Operates 0500-2200. (Balbi, California, via URDXC)

Australia—Perth appears to have replaced VLW7, 9.52, with VLW5, 9.610. (Stark, Texas.) Move to 9.610 confirmed by Dilg, California, and by Eyles, Georgia. Has powerful signal here in West Virginia until around 0845 when begins to fade badly.

Austria—Radio Wien, Vienna, has been heard in England on 7.240 and 9.664 to 1805 sign-off following a news summary in German; some days has *"English by Radio"* at 0415-0430; (on Fridays at least, this program is also carried by the *Rot-Weiss-Rot* station, 9.575); German programs are resumed at 0430; the 11.78

channel is heard well in Britain mornings and afternoons (EST). (Pearce)

Belgian Congo—Leopoldville has moved from approximately 9.745 to (announced 9.767 (may vary); in the North American beam, now following the 2100-2115 news, there is a program called *"Amongst Friends"* when listeners' letters and reports are answered over the air (*not Sundays*). (Wellnitz, Illinois.) Moved due to QRM from a telephone transmitter; operates here *only* 1700-2300. (Beck, N.Y.)

Belgium — Radio Nationale Belge, 17.840, Brussels, has been heard in Philadelphia at 1100 with musical program and talks. (Southall, Pa.) Evidently, this is beamed to Leopoldville, Belgian Congo.

British Honduras—ZIK-2, 10.598, Belize, is scheduled daily 1330-1358; is partly readable in Georgia; program is world and Honduras (local) news. (Eyles.) Some days may come on as early as 1300.

Burma—Radio Rangoon, 6.035, still has news daily 1000. (Radio Week, South Africa). Confirmed by Dilg, California.

Cameroun—In verifying for Kary, Pa., *Radio Douala* listed transmitter as a *Temco* with 600 watts output, frequency of 7.950, scheduled *daily* 1300-1500, but runs to 1600 Sundays; has concert music 1300-1330; local and world news (French) 1330-1350; French songs 1350-1400; "Varietes Douala" 1400-1415; concert music 1415-1500; the Sunday period 1500-1600 is devoted to uninterrupted dance music. A *new* period is to be heard on Sundays at 0615-0745 with a variety program. On the 1st, 2nd, 15th, and 16th of each month at 1325 they answer letters and reports from listeners (presumably in French), it was stated. Kary heard this station around 1430-1500. Is also heard in Newfoundland. (Peddle)

Canada — Summer schedules effected April 18 by CBC's International Service are: To Europe—0800-1700, CKNC, 17.82; 0800-1045, CKCX, 15.19, and 1045-1700, CKCS, 15.32. To the Caribbean (*English*) —1820-1930, CKNC, 17.82, and CKCX, 15.19. To Latin America—1930-2000 (Portuguese, Tuesdays *only*), 2000-2100 (Spanish), CKNC, 17.82, CKCX, 15.19. To the Canadian Arctic (*English*)—2310-0005 (Sat.-Sun. *only*), CKLO, 9.63, and CKOB, 6.09. To Australia and New Zealand (*English*) — 0345-0530 (Sundays *only*), CHOL, 11.72, and CHLS, 9.61. All these programs are beamed from 50-kw. transmitters at Sackville, New Brunswick, with programs originating from studios in Montreal, Quebec.

CJCX, 6.010, Sydney, Nova Scotia, is heard in Philadelphia, signing on 0645.

Celebes—Major, Western Australia, reports YFA4, 9.380, Macassar, good to 0930 sign-off (is in parallel with YFA10, 5.030, which is good at 0830). However, Pearce, England, reports hearing the 9.350 outlet to 1500 (closedown).

Look at these EXCLUSIVE "G & G" BUYS!

BC-645 XMTR RECEIVER 15 TUBES 435 TO 500 MC

BRAND NEW!

$9.75

2 for $18.95

The electronic equipment that saved many lives in the war. Set can be modified to use for 2-way communication, voice or code, on following bands: ham band 420-450 mc, citizens radio 460-470 mc, fixed and mobile 450-460 mc, television experimental 470-500 mc. 15 tubes (tubes alone worth more than sale price!): 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955 and 1—WE316A. Now covers 460 to 490 mc. Brand new BC-645 with tubes, less power supply in factory carton. Shipping weight 25 lbs.

PE-101C DYNAMOTOR for above BC645 ..... $2.95

UHF ANTENNA ASSEMBLY

A rare bargain for UHF experimenters! Consists of 7 aluminum rods, in calibrated lengths as follows:

3 rods 12" long for 200-247 Mc
1 rod 9½" long for 248-313 Mc
1 rod 7½" long for 312-400 Mc
1 rod 5-13/16" long for 402-517 Mc*
1 rod 4-13/32" long for 512-667 Mc

All rods in handy fabric pouch. Two UHF coaxial coupling insulators included. All BRAND NEW, in original carton, yours for only $2.45

*2 of these rods suitable for BC-645 Transceiver

TU-75-B XMTR TUNING UNIT

Hams! You'll want this! Tuning unit uses 3—815 tubes. Has 5 tuning condensers, coils, all components easily converted to 2-meter rig! BRAND NEW, in original carton, with tubes, all yours for $14.95

TERRIFIC VALUE!

24-VOLT STORAGE BATTERY, BRAND NEW! 11-AMP. HRS.

Made by Delco. 12 cells, heavy duty, very rugged. Shipped dry, uses standard sulphuric acid electrolyte.

VERY SPECIAL . . . $14.95

SPECIAL! 24 VOLT

Delco 12-cell Storage Battery

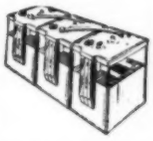
17 ampere-hours. Only a few left at $16.95

6-VOLT STORAGE BATTERY

Navy Standard BRAND NEW, 15 ampere-hour rating $4.95

WILLARD 6-VOLT STORAGE BATTERY

27 amp. hrs.



3-cell battery, transparent plastic case, very specially priced $4.50

WILLARD 2-VOLT STORAGE BATTERY

20 Ampere-Hours

Exact replacement for GE portables—**brand new.** Each $1.49

ONE-QUART BOTTLE BATTERY ELECTROLYTE

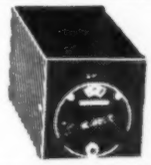
Made by Willard, for above storage batteries. 1 quart sufficient for two 2-volt cells. Hermetically sealed. SPECIAL, per qt. bottle 95¢

7-PRONG 2-VOLT RADIO VIBRATOR for Portable and Farm Sets Replacement for GE LB 530 ..... $1.65

Down Come Prices! CATHODE RAY TUBES

All Brand New, in Original Cartons

5BP1 Lots of 4, each	$1.79
5BP4 Lots of 4, each	1.95
3FP7 Lots of 4, each	1.49
304TL Emac, each	$2.95
GE-211 Each	1.22



RCA AVT-112A AIRCRAFT XMTR

2500 to 6500 Kc, 6 tubes, compact, powerful, operates on 12 volt source.

Less crystal, BRAND NEW $12.95

RADIO RECEIVERS

All Brand New in Original Cartons

BC-454A 3.1 to 6 Mc complete with tubes $6.95

40-WATT VFO DRIVER

BC-457A 4 to 5.3 Mc. $6.95
BC-458A 5.3 to 7 Mc. 6.95

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COMPLETE I.F.F. Equipment

RC-188-A

Bargain opportunity of a lifetime! This I.F.F. equipment originally cost about $20,000, you can now buy it for a tiny fraction of cost! Easily converted for Television. Complete assembly consists of Control unit with 5" C.R. Tube, transmitter and receiver assembly (157 to 185 Mc) Indicator unit, and Power Supply (450 watts) operating on 110 volts, 60 cycles AC. All assembled, ready to operate. 62 Tubes included: 8—6V6GT, 9—6SL7GT, 14—6SN7GT, 1—5CP1, 2—9006, 1—6Y6G, 2—6E5, 1—100TH, 2—6J5, 2—2C26, 1—3E29, 1—6H6, 7—6AG5, 3—6AK5, 1—6C4, 3—2X2, 1—6X5GT, 3—5U4GT. Overall size 55" high, 28" wide, 20½" deep. Shpg. weight 855 lbs.

Your cost, complete, BRAND NEW, in original packing $195.00

BC367 Interphone AMPLIFIER

Here's a terrific value for you! Unit comprises a 2-watt audio amplifier with input and output transformers; 600 cycle audio oscillator for signalling. Housed in compact metal case. Originally built for Signal Corps. Complete with two 6V6 tubes. Slightly used, your cost $4.95

BRAND NEW, in original carton $6.95

HANDMIKE T-17

Shure model T-17 mike 200-ohm carbon single button, with press-to-talk switch, 5-ft. rubber cord and plug. BRAND NEW, individually packed, lots of 3 ea. 99c

Please include 25% Deposit with order—Balance C.O.D. Minimum order $3.00. All Shipments F.O.B. Our Warehouse N.Y.C.

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RADIO PARTS SERVICE
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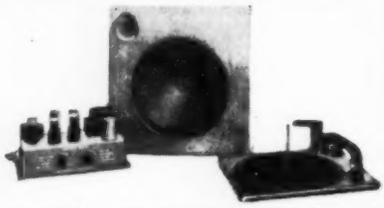
Sun Radio Presents:

A New Idea In HI-FIDELITY Reproduction At Low Cost!

BOGEN "PK" SYSTEM



A carefully matched combination of high-quality, **custom-engineered** components, especially designed for high fidelity reproduction of music.

INCLUDES:

BOGEN PH-10 AMPLIFIER

A virtually humless, high-fidelity, 10 Watt Amplifier, with Multi-Range Tone Control. Frequency response (full range): ±1 DB, 40-15,000 cps.

WEBSTER RECORD CHANGER

Latest Model Webster No. 148 automatic record changer, equipped with superb new Astatic Nylon IJ crystal cartridge and permanent sapphire needle. This changer features automatic disconnection of pickup during change cycle, eliminating transfer of changing-noise to speakers.

DUAL HI-FIDELITY SPEAKERS

Consists of Alnico V 12" woofer speaker and single University tweeter with crossover network, all mounted and wired on flat baffle, 16" x 16". Frequency response: 60-15,000 cps. Crossover freq: 2500 cps.

The entire unit is fully wired and complete with tubes. Instructions for assembly and mounting included.

LIST $141.60 COMPLETE PACKAGE

Full trade discounts to all servicemen, dealers, amateurs, students, experimenters, engineers, sound men, etc.

WRITE FOR YOUR COST!

FREE BARGAIN BULLETIN!

Write for Sun Radio's bulletin of big, money-saving specials in sound equipment, as well as bargains for amateurs, hobbyists, etc.

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Name.....

Address.....

City.....Zone.....State.....

Ceylon—Major, Western Australia, reports ZQO16, 21.630, Colombo, heard at 0700-0800 contacting ZLT7, Wellington, New Zealand, and later with ZLM5, linking this station with ZQO16 in contact with GL12, London, for radiophotos. He says ZOH, 4.900, Colombo, has good signal 0730.

Cushen, New Zealand, recently informed *Radio Australia* that *Radio SEAC*, Colombo, had been heard on 9.915 instead of listed 9.520; may have moved?

China—(*NOTE*: It is quite likely that by this time most Chinese outlets will have gone on Summer Time, making their schedules 1 hour *earlier* than listed below.—K. R. B.)

Major, Western Australia, reports these Chinese stations—XPTA, 11.650, Canton, good 0700, relays XGOY news 0900; XLRA, 11.500, Hankow, good 0600, but with heavy QRM; XGAS, 11.680, *Changsha*, good 0700-1000 sign-off, relays AFRS news 0800, carries same program as 7.105; XGOE, 9.868, Kweilin, good 0630; XPSA, 7.010, Kweiyang, poor with QRM, a close watch reveals no *English* used; XGHT, 6.070, Hantan (Communist-controlled), fair 0820; signals from ZBW-3, 9.525, Hong Kong, improve around 0900. Dilg, California, says Hong Kong's signal remains poor there, signs off 1000; he also reports XGAS often takes AFRS news at 0800, the same as XMAG, 4.275 (Nanking), and JKD, 6.015, and JKE2, 4.860 (both Tokyo). Location of XGAS remains in doubt; New Zealand sources give it as Kungchun. Clark, New Zealand.)

XGIO seems to be on approximately 8.400, has very good signal on West Coast some days around 0830, may run later on occasion. (Dilg) Sanderson, Australia, reports this one as 8.450 at 0530 with AFRS programs; lists it also on 9.99, "very close to WWV," at 0645 with Chinese news and music.

XGOY, Chungking, has left 6.140. Current schedules appear to be: To Australia. New Zealand, East Asia, 15.17, 0455-0630; *no English* except Saturday at 0600 has "Back to the Bible" and Sunday at 0530-0630 has "The Baltimore Gospel Hour." To East Asia, South Seas, 15.17 and 7.153, 0635-0835; news 0700; on Wednesdays at 0735-0750 has "Sermons in Song." To North America, Europe,

(Continued on page 163)

Recording Amplifier

(*Continued from page* 73)

the proper position of the cable connector. Note also the elimination of one extra tube which was found to be unnecessary but which was shown in the original photographs.

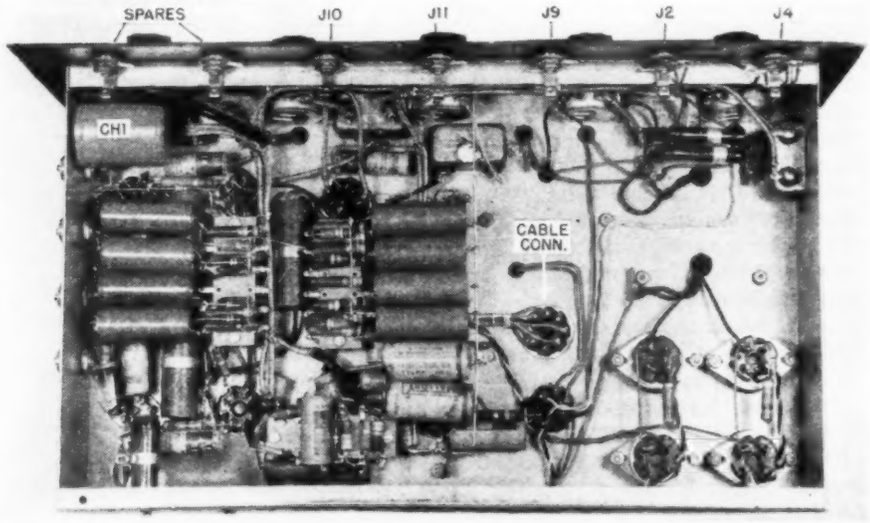
Shunt resistors are inserted across each half of the secondary of T_1 to provide suitable transformer loading for fixed-bias operation.

While all of the improvements mentioned above are recommended, many readers may prefer to use self-bias, and if so, we recommend only the alteration of the filament supply. In such cases the tap on the full-wave selenium rectifier supply should be adjusted to the value of +75 volts, and the *"C"*-tap eliminated.

Many readers have requested the design of an amplifier to be used specifically for phono-reproduction and employing 6V6's or 6L6's in the output. We are, therefore, engaged in the design of two amplifiers that provide high fidelity and which incorporate full equalization for almost any type of response required for various types of applications. Complete data will appear in an early issue.

—30—

Under chassis view showing wiring detail and location of various components.



RADAR AIRCRAFT

DYNAMOTORS

PE 73 CM (G.E.) Power supply for BC 375 Input: 28 VDC Output: 1000 VDC @ 350 Ma. New $4.95

BD 77KM Power supply for BC 191 with spare fuse links, etc. Input 11 v.d.c. Output 1000 v. @ 350 ma. Army re-issue, ex. cond. $5.95

MFRS: Write for quantity prices and discounts on above items.

PE 101-C input 13/26 VDC @ 12.6/6.3 A. Output: 400 VDC @ 135 Ma. 800 VDC @ 20 Ma. 9 VAC 1.12 A. New $3.49

PE 86 N. Input: 28 VDC, Output: 250 VDC @ 60 ma. without filter $3.95

PC 77. Input 12 VDC. Output 275 VDC @ 110 Ma. 500 VDC @ 50 Ma. $3.25

DAG 33A Input: 18 VDC @ 3.2 A. Output: 450 VDC @ 60 Ma. $2.45

DM 33: Input 28 VDC @ 7 a. Output: 510 VDC @ 250 Ma. Power supply for SCR 274 modulator $3.95

DM 23350: Input: 27VDC @ 1.75 A. Output: 285 VDC @ 75 Ma. $1.75

DM 21: Input: 14 VDC Output 235 VDC @ 90 Ma. Power supply for BC 312 ..... $2.49

PE 55. Input: 12 vdc @ 25 amp. Output 500 vdc @ 400 ma. (slightly used) ex. cond. $4.95

MP 10 G Power supply, using 2 dynamotors. Input: 24-28 vdc. Output: 1000 vdc @ 400 ma. 250 vdc @ 100 ma. New, complete with relays, filters, etc. BENDIX $40.00

B-19 power pack (dynamotor). Input: 12 vdc @ 9.4 amp. Output: 275 vdc @ 110 ma. 500 vdc @ 50 ma. New, complete in metal case with 2 plugs, filters, etc. $4.75

DM 28-R. Input: 28 v.d.c. @ 1.25 amp. Output: 270 v.d.c. @ 70 ma. New, with enclosed terminal box $3.25

ZA/USA .0515. Input: 12/24 vdc @ 4/2 amp. Output: 500 vdc @ 50 ma. Compact square shape, size 7½"x4¼"x3" $3.95

ZA/USA 0516. Input: 12/24 vdc @ 8/4 amp. Output: 275 vdc @ 110 ma., 12 vdc @ 3 amp. Compact square, size: 7½"x4¼"x3" ... $4.25

3X055. Input: 19 vdc @ 3.8 amp. Output: 300 vdc @ 95 ma. $2.20

DM-25: In 12VDC 23A Out 250DVC 50 ma. $2.49

DM-34: In 14VDC 2.8A Out 220VDC 80 ma. $2.49

DM-42: In 14VDC Out 515/1030 VDC 215/260 ma. and 2/8VDC $3.95

INVERTERS

PE 206-A. Input: 28 vdc @ 28 Amp. Output: 80 volts @ 500 volt-amp. 800 cy. Leland Electric. New, complete with instruction book, relays, filters, etc. $12.50

PE 218—Input: 25-28 vdc @ 92 amp. Output: 115 volts. 1500 volt-amps. 380/500 cy. Leland Electric. New $15.00

"Communications"

ARC-5 ACCESSORIES

CONVERSION COILS FOR ARC-5 TRANSMITTERS

M.O. Coils	P.A. Coils	Antenna Loading Coils	Freq. Range
$1.00 each	$1.00 each	$.85 each	
⌀6029	⌀7247	⌀6033	3-4 Mc.
⌀6030	⌀9293	⌀6034	4-5.3 Mc.
⌀6032	⌀9295	⌀6035	7-9.1 Mc.

CONVERSION KIT, consisting of 1-M-O coil, 1-P.A. coil, 1-ANTENNA COIL, in any one particular frequency range $2.00

ARC No. 6558 variable receiving capacitor, 62 mmf/section, 3 sections, .03" spacing, 8 rotors. Worm drive ratio 33:1 ..... $1.75

ARC No. 4990 variable xmtg. capacitor, 22.4—145 mmf, .05" spacing, 11 rotors. Each $1.00

ARC 5032 Var. Xmtg. capacitor, 29.2—117 mmf. .06" spacing, 16 rotors, worm drive: 96:1 ..... $1.00

Single revr. mtg. racks $1.00

Dual mtg. racks (revr.) $1.50

Single shock mounts for rack ..... $ .50

DUAL CONTROL BOXES FOR RCVRS $1.00

CATHODE RAY TUBES

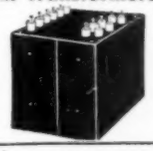
5BP1 . . . $1.20

3BP1—$1.25 ..... 5FP7—$1.75

3FP7—$1.20 ..... 5JP2—$4.00

24-Volt Filament Transformers

Input: 117 V, 60 cy. Output: 24 volts @ 3 A. (As shown) Size: 3" x 3½" x 3" each **$1.50**



HEADSETS

Dynamic mike and headset combination. A high quality efficient unit, used in B-19 tank Xmtrs. Mike & phones comp,, new **$2.75**

R-15 headsets: 8000 ohms impedance, rubber cushions. Comes with 8" cord & plug PL 55. New **$1.95**. Used, in good cond. **$.60**

HS 30 headset. Insert type headset cuts out background noise, and low impedance (500 ohms) assures efficiency and high fidelity. A MUST for every ham at this price..... **$.85**

Xfmr to match 800 ohms output ..... **$.35**

H.V. MICA CONDENSERS

.08 mf @ 1500 VDC, Sprague MX60 ..... $11.50

.03 mf @ 2000 VDC, CD 551A-50 ..... 12.75

.015 mf @ 2000 VDC, Sangamo, G1 ..... 12.75

.00015 mf @ 20 KV, Aerovox 1970-401 ..... 25.00

.0001 mf @ 20 KV, Sangamo G3 ..... 25.00

.0051 mf @ 15 KV, Sangamo G4 ..... 25.00

.006 mf @ 10 KV, Sangamo G3 ..... 17.50

.002 mf @ 15 KV, Sangamo 20.00

Isolating Capacitor, Cornell-Dubilier PL 1417, 106-110 mmf @ 10 KV AC (peak) Each 3.50

MFRS.: Send your requirements for bathtubs, Micas, Hardware, resistors, and connectors.

AMATEUR INDUSTRIAL

TEST SET 159TPX

Measures frequency between 150-200 Mc. by heterodyne method. Pwr. Output of XMTR can be measured directly. Measures DC voltages up to 500 V. Operates on 110 V. 400 cy. Complete with tubes, crystal, calibration chart. Conversion kit for 60 cy. $29.95

SONAR SOUND DETECTION UNIT

Ideal for detecting under water sounds, such as fish swimming in schools, within a 15 mile area. Using a Rochelle salt crystal, which is about 1000 times more sensitive than quartz. It is completely enclosed in a solid rubber sheath. This sound detector was originally used in harbor defense. Coupled to an audio amplifier, this can be found to have many valuable applications. It's the Model JR which contains 7 microphone units $12.50

TRANSFORMERS

(ALL PRIMARIES 117 V, 60 CYCLES)

⌀5084. **POWER TRANSFORMER.** 550-0-550 volts @ 250 ma. ½ sec. tapped @ 400 v. 65 ma. Sec. ⌀2: 6.3 v. @ .3 amp. net. $5.95

Power Pair: xfmr 470 v.c.t. @ 60 ma. 6.3 v. @ 2 amp. PLUS a 6hy 50 ma. choke. Both for only $1.75

FILAMENT TRANSFORMERS

⌀5123: 6.3 vct @ 5 amp, 6.3 vct @ 1 amp $2.15

⌀5109: 27 volts @ 8.8 amp, 6.3 v. @ 2.5 amp $2.75

⌀13163: 2.5 v. @ 1.75 amp, 5 v. @ 3 amp, 6.5 v. @ 6 amp, 6.5 v. @ 8 amp $5.35

Doughnut Fil. Xfmr. Two 5.1 v. windings @ 5 amp each, 15,000 volt test $7.50

No. 5038: 6.3 VCT @ 2A, 6.3 VCT @ 2A, 6.3 VCT @ 2A $2.25

No. 5100, 6.3 VCT @ 1.2 A, 5000 V test $1.35

No. 5080: 6.3 V NCT @ 6A, 6.3 V NCT @ 1.5 A $1.40

No. 5056: 6.3 VCT @ 9 A, 6.3 VCT @ 2.2 A, 6.3 VCT @ 2.2 A $2.50

No. 5057: 6.3 VCT @ 1 A, 5 VCT @ 3 A, 5 VCT @ 3 A $2.50

UX 6899: 5 V @ 5.5 A, 5 V @ 5.5 A, 20,000 Volts Test $24.50

⌀5083: 6.3 vct @ 1 amp, 5 v. @ 2 amp.. $1.55

POWER CHOKES

6 Hy @ 150 ma. $1.50

6 Hy @ 300 ma. $3.25

1 Hy @ 800 Ma. 7.5 Ohms $8.95

Dual-Choke: 2-2 Hy @ 100 Ma. ..... $ .90

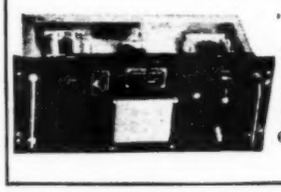
Dual Choke: 7 Hy @ 75 Ma. 11 Hy @ 60 Ma. $1.50

8.5 h @ 125 ma. $1.50

25 h @ 65 ma. $1.10

HI-FI OUTPUT TRANSFORMER

W.E. ⌀KS 9496. 9000 ohms p-p plates to 9 ohm voice coil. Handles 250 watts. Freq. response:—1.25 db @ 100 cy. 0 db @ 1000 cy.—.3 db @ 10 kc,—3 db @50,000 cy. Weight: 14¼ lbs. New $3.95



TU-6B TUNING UNIT

From BC 375 xmtr. freq. range: 3—4.5 mc. Makes an excellent VFO on 80 meters. Complete—only **$2.25**

ANTENNA, AN/122-A. Used in 4-element adcock arrays for high gain and directivity (as shown), each dipole element is 12' long, made of ⅝" tubing. Excellent for that new 6 or 2-meter beam. Don't miss this great value.

$5.65 each or 4 for $20.00

ANTENNA AN/104-A. The famous Ax-handle antenna, used with the SCR 522. Ideal for mobile quarter wave, because of its streamline construction; or 2 units can be used to form a dipole for 2 meters or for TV and FM reception. Consists of copper sheath 21" long moulded about a wooden support, with 83-1R coax connector.

$.75 each or 2 for $1.35

AN/128-A. For high gain and directivity on 2 meters. Consists of 2 vertical elements working against a square reflector, approx. 3' x 4'. Impedance is 50 ohms. $40.00

WIRE RECORDING MAGAZINES

Magazine for KS 12009 recorder, made by W. E. Comes with wire for ½-hour recording. Has elapsed time indicator, recording and erase features Size: 14¾" L x 7" W x 5¾" H. Less Drive Motor **$30.00**

MICROWAVE TUBES

(Magnetrons)

TUBE	FREQ. RANGE	PK. PWR. OUT	PRICE
2J31	2820-2860 mc.	285 Kw.	$15.00
2J21-A(725-A)	9345-9405 mc.	50 Kw.	$25.00
2J22	3267-3333 mc.	265 Kw.	$15.00
2J26	2992-3019 mc.	275 Kw.	$15.00
2J27	2965-2992 mc.	275 Kw.	$15.00
2J32	2780-2820 mc.	285 Kw.	$15.00
2J38	PKG. 3249-3263 mc.	5 Kw.	$25.00
2J55	PKG. 9345-9405 mc.	50 Kw.	$25.00
3J31	24,000 mc.	35 Kw.	$17.50
W.E. 700-A	680-710 mc.	100 Kw.	$35.00
W.E. 720BY	2800 mc.	1000 Kw.	$25.00

MAGNETS for 2J21-A(725-A), 2J22, 2J36, 3J37, 2J26, 2J27, 2J31, 2J32 and 3J31, each ..... $ 8.00

Field Strength Gauss	Distance Bet. pole faces	Pole Face Diameter	Price
4850	⅝"	⅜"	$ 8.00
1500	1⅛"	1⅝"	$ 8.00
1000	Adjustable		
(Electromagnet)	2⅜" to 3"	2¼"	$12.00
2100	1¼"	⅝"	$ 4.00

THOUSANDS OF ITEMS IN STOCK. WRITE FOR YOUR NEEDS.

All merchandise guaranteed. Mail orders promptly filled. All prices, F.O.B. New York City. Send Money Order or Check. Shipping charges sent C.O.D.

COMMUNICATIONS EQUIPMENT CO.

131 N. Liberty Street, New York City 7, N. Y. Digby 9-4124

A COMPLETE LINE OF MICROWAVE EQUIPMENT IN STOCK. WRITE FOR MICROWAVE FLYER

HARD TO GET LEOTONE SPECIALS

WIRE AND TAPE RECORDING COMPONENTS

Essential "hard-to-get" basic parts for units described in Radio News, Feb., '48.

WIRE RECORDING-PLAYBACK HEAD. Precision built Three-Coil (Record, Playback & Erase), 4 pin plug-in type. Moulded bakelite case (1¼"x1"x⅞"), "y" grooved to provide maximum wire contact & sensitivity $6.95

WIRE SPOOL SPINDLE. Polished aluminum. Takes spool with 1⅝" hole. ¼" shaft hole. ¾" deep ..... $.39

RM-4 RECORDING MOTOR. Recommended heavy duty type. 110V., 60 cycles. Adaptable to WIRE, TAPE or DISC RECORDING & PLAYBACK. 5/16" O.D. shaft, 3⅜" sq., 2⅜" deep. Less turntable, mtg. plate & reduction drive wheel. SHPG. WT. 6 lbs $4.95

PERMALLOY OUNCER LAMINATIONS. Hydrogen annealed. Specifically for use in constructing TAPE RECORDING-PLAYBACK HEADS Per ouncer (containing laminations) ..... $.40

ALNICO ERASE MAGNET. For TAPE or WIRE. "U" shape; polished poles. ¾x⅝x⅝". 3/16" gap ..... $.39

Send for latest illustrated ALNICO MAGNET supplement.

RADIO HARDWARE TREASURE. An indispensable assortment of approx. 1000 nuts, screws, washers, lugs, etc. ..... $.49

CASED POWER RHEOSTAT. 25 watt-350 ohm, ceramic. Moisture-proof metal case (3½"x3½"x3") with bronze pointer knob. Shpg. wt. 4 lbs. ..... $.98

HEARING AID PARTS

Famous make miniature audio units having many applications where space is limited.

BONE CONDUCTION RECEIVER. Sensitive moving armature type. Makes excellent CONTACT (musical pick-up) MIKE; MINIATURE or PILLOW SPEAKER. 1½" x ¾" x ½". Low impedance ..... $2.95 4 for 9.95

MIDGET OUTPUT TRANSFORMERS (13/16"x¾"x½"). One of the smallest made. High imped. to Voice Coil. For personal & portable set, intercoms, etc. ..... $.49

MIDGET AUDIO CHOKES (¾"x¾"x½"). 4500 ohms DC. Use in filter circuits, impedance coupling, etc. ..... $.49

ALNICO V MAGNETIC PHONE UNITS (HS-30 headset replacements). Wide freq. response & sufficient volume for use as PM or PILLOW SPEAKER; DYNAMIC or CONTACT MIKE. 250 ohms imped. ¾" O.D., ½" deep ..... $.39

TUBES! TUBES! TUBES!

STOCK UP NOW AT THESE LOW PRICES— All in perfect condition, but in unsealed cartons. Most types available at up to 80% off list. Every tube guaranteed 90 days.

#20, 27 or 31	$ .29
#42, 75, 76, 77, 78, 6H6 or 6K7	.39
#36, 37, 39, 5Y4, 5W4, 5Z4, 6C5, 6F5, 6J7, 6K8, 6SA7, 6SD7, 6SF7, 6SH7, 6SJ7, 6U7 or 12SK7	.49
#1A7, 1H5, 6U5, 6X5, 7A7, 50, 50B5 or 50L6	.59

TUBE CARTONS. PLAIN

Miniature (1"sq.x2¼") per 100	.98
GT size (1¼"sq.x3¼") Per 100	1.25
Medium (1½"sq.x4¼") Per 100	1.49
Large (2"x5") Per 100	1.79

4 TUBE AMPLIFIER (2-7C5, 7F7, 7Y4). See Radio Craft, July, '47, for conversion to Phono Amplifier. Orig. supercharger control, 110v, 400 cycle. Contains: power trans, 7 mica & oil cond., 7 resistors, 4 loctal sockets, PLUS other components worth several times the price. Black wrinkle finish case & slide-in chassis. 8¾"x4½"x3¾". Shpg. wt. 4 lbs. Less tubes $1.49

SPEAKER CONE KIT

12 asstd. 4" to 12" molded and free-edge (magnetic incl.) Less voice coils $2.00

Get on our mailing list • Always something new • Factory Repair Service on all speakers and phono pick-ups • Minimum Order $2.00 • 20% deposit required on all orders • Please add sufficient postage

LEOTONE RADIO CO.

MAKERS OF CONES AND FIELD COILS
65-67 DEY STREET. NEW YORK 7, N.Y.
WORTH 2-0284-5
12,000 SQ FT OF RADIO PARTS

What's New in Radio

(*Continued from page* 88)

Craft Company of Brooklyn, New York has begun production of a series of hardwood cabinets.

The cabinets feature 8" speakers, lucite masks, safety glass, recessed base design, and felt cushioning. In addition, the company is manufacturing a "liquor service cabinet" which may serve as a base for table model television sets.

MULTI-RANGE V.O.M.

A wide range tester with several new features has been introduced by *The Triplett Electrical Instrument Co.*

The new unit has a 5.6" mirror scale for improved reading accuracy and features 39 ranges. Resistance measurements can be made on ranges covering from 0-2000 at the low end to a high of 40 megohms. Dual d.c. voltage ranges 2500 and 5000 at 20,000/10,000 ohms/volt respectively provide double the number of full scale readings usually

available. The a.c. volt ranges to 5000 at 10,000 ohms/volt permit checking audio and high impedance a.c. circuits where a vacuum tube voltmeter is usually required. Low voltage ranges permit direct measurement of many bias and output voltages. The d.c. current ranges are covered from 0-50 microamperes to 0-10 amperes while decibels may be read from minus 30 to plus 69 db.

The Triplett Electrical Instrument Co., Bluffton, Ohio will provide added details on the Model 625-NA to those requesting such information.

SOLDERING GUN

A new type soldering gun designed especially for the radio, television, and appliance serviceman has been announced by *Weller Manufacturing Co.*

A small spotlight, placed between the terminals of the loop tip, keeps the work in plain sight. The tip can be flexed to suit the job and can be shaped to get into difficult and tight places. The spotlight goes on automatically when the trigger switch is closed for heating the gun. It spots the joint to be

MAY SPECIAL

RESISTOR KITS $1.45 100 assorted carbon and wire wound resistors . . . ½ to 10 watt. Wide range of value. All standard items.

CONDENSER KITS $1.75 50 assorted paper and mica condensers . . . all new . . . good value.

Wireless Phono Oscillator $4.52

Operates as far as 100 ft. from radio and can be used with automatic record changer and players . . . complete with 2 tubes all wired and tested. Diagram.

Phono Pre-Amplifier $4.95 This unit is for G. E. Reluctance type cartridge. Completely wired, tested. Supplied with diagram, and tube 6SC7.

Mike and Phono Amplifiers $14.95 This unit sold complete with power transformers, 3 tubes and 3 controls . . . all wired and tested. Diagrams supplied.

RADIO PARTS

Astatic Crystal Pickups	$1.89
Astatic Crystal Cartridges, L-70A, L-26A, L-40	1.60
Selenium Rectifiers 100 MA	.69
½ Meg. Volume Controls & Sw. Long Shaft	.35
Osc. Coil 12SA7	.15

STANDARD MAKE CONDENSERS

50x50—150V.	$ .45	.01, .02, .05	$ .06
8x8—450V.	.50	.1	.07
25—25V.	.30	4" or 5" PM Spk.	1.15
25—50V.	.30	6" PM Speaker	1.55
16—450V.	.40	5" 450 ohm Dynamic with output	2.39

All Prices F.O.B. N.Y.C.—On C.O.D. 25% Dep.

THE ROSE COMPANY

88 West Broadway Dept (N) N.Y. 7, N.Y.

a "MUST" for TELEVISION SERVICING

for trouble shooting on the kinescope high voltage power supplies.

HIGH VOLTAGE KILOVOLTMETERS

0—15 KV
0—30 KV
0—50 KV
20 MICROAMPERES FULL-SCALE!

50,000 ohms per volt

Will not overload the cathode ray tube power supply or change picture size.

SAFE • ACCURATE • PORTABLE

A 10" long lucite safety handle permits voltages to be measured without turning the H.V. power supply on and off to connect in the voltmeter. Housed in oak case with black bakelite panel and leather carrying handle.

Don't take chances of burning out valuable test equipment! Use a meter designed especially for measuring ultra high voltages.

USED BY ALL LEADING TELEVISION MANUFACTURERS AND THEIR SERVICEMEN THROUGHOUT THE COUNTRY: R.C.A.; Dumont; Sylvania; Philco; U.S. Television; Tele-tone; R. H. Scott and others.

15, 30 KV ranges	11"x 8"x 5"	$69.50
50 KV range	13"x 9"x 6"	$110.00

F.O.B. New York

BETA ELECTRONICS CO.

1762 Third Ave., New York 29, N. Y.

soldered in the maze of wiring, thus facilitating the work and saving time.

The gun features 5-second heating which makes the tool suitable for intermittent duty. The unit operates on a.c. only. Two models are available, one with a single heat of 100 watts, the

other with a dual heat control which provides 100 watts normal heat and a 35% instantaneous reserve heat.

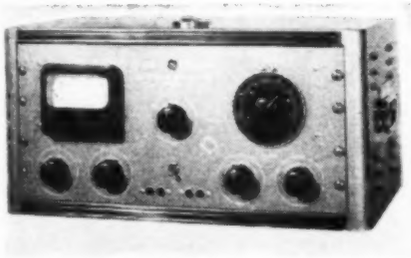
Weller Manufacturing Company of Easton, Pennsylvania will supply additional details on request.

DISTORTION-NOISE METER

The *Specialty Division* of *General Electric Company* has announced production on a new distortion and noise analyzer, the Type YDA-1.

Designed for broadcast, television, research, and developmental applications the new unit combines four basic functions. It will measure percentage of distortion down to .1 per-cent, measure hum or noise present on an audio signal, act as a high sensitivity vacuum tube voltmeter, and perform as a frequency meter over the range 50 to 15,000 cycles.

Distortion ranges of 1, 3, 10, 30, and 100 per-cent full scale are provided.



Accuracy is 5 per-cent of full scale, plus .1 per-cent.

Further information on the Type YDA-1 distortion and noise meter is available from the *Specialty Division, General Electric Company,* Electronics Park, Syracuse, New York.

SMALL TRANSMITTER

Harvey-Wells Electronics, Inc. has introduced a new small transmitter, the TBS-50. This 50 watt unit has been designed for phone or c.w. operation with eight bands from 80 to 2 meters with bandswitch and no plug-in coils.

The transmitter is crystal controlled

SAVE $ ON RADIO SURPLUS

***ATTENTION*: Prospectors, Explorers for Hidden Treasures!**
Do you seek hidden treasures or rare metallic ores? If so, construct a U.S. Army Type of Metallic Mine Detector from these U.S. Army Mine Detector Amplifiers that we are offering at a ridiculously low price. Complete Amplifier (as illustrated) (less tubes and batteries) with Battery case and cables. Cables, headphone cord and jack (no phones). Complete Army wiring diagram. U.S. Army DETECTOR SET Amplifier Type AN/PRS-1, as described... Only

$1.65 ea. No C.O.D.'s. Eveready 45 volt batteries #482, 6 volt A. **73c**. 2—1N5 tubes, **95c** ea.

U.S. SIGNAL CORPS 5 METER SHORT WAVE XMTRS.
(72.2Mc) XMTRS and TUBE only, less mike, batteries and antenna. One 1½ volt dry cell and 67½ volts of B operates it. Just attach di-pole, key or mike, connect the batteries and it's ready to use. Signal Corps spec. wired with silvered wire, mica condensers, and precision resistors. Highly stable circuit with Lo-Loss silvered inductance. (Adjustable padder) Schematic supplied. Converts easily to walkie-talkie and Ham bands **$3.25**

SELENIUM RECTIFIERS
Lost of 12 ..... **65c** Single Lots **75c**

GENUINE SIGNAL CORPS FEATHERWEIGHT HEADPHONES WITH CORD AND PLUG 2000 OHMS—8000 OHMS IMPEDANCE **$1.00**

SPRAGUE—NATIONALLY KNOWN OIL FILLED FILTER CONDENSERS
1.—MFD—1000 working volts. 4 for **$1.00**

FAMOUS BRAND RECORD CUTTING HEAD
These units are all Brand new and were made for a nationally advertised manufacturer to be in their quality Home Recording Radios. Size 1⅜x2⅞ ready to fit your cutting arm or bracket. **SPECIAL** **$2.95**

3 BAND ALL-WAVE DIAL 6" DIAMETER 75c

AMPLIFIER CHASSIS, SIZE 18"x8"x2½". BLUE CRACKLE FINISH DRILLED FOR CONDENSERS —TRANSFORMER AND SOCKETS 65c

STROMBERG - CARLSON, 3 BAND ALL - WAVE TUNING UNIT, COMPLETE WITH TRIMMERS, BY-PASSES AND BAND SWITCH, READY TO INSTALL—DIAGRAM, etc. $3.75

8 OR 9 GANG PUSH BUTTON TUNING UNIT (PLEASE SPECIFY). COMPLETE WITH BUTTONS 25c

24 VOLT D.C. AIRCRAFT MOTOR, APPROX. ¼ H.P. ALMOST NEW $1.50

U.S. AIR FORCE RESISTOR ASST. ⅛-½-1 WATT —100 PIECES 95c

U.S. AIR FORCE MICA COND. ASST. 100 PCS. $1.25

Low-Loss-Short Wave Variable Condensers ½" Shaft Type
3 Plate—12-15 MMFD. 15c
5 Plate—20 MMFD. 20c
9 Plate—36-40 MMFD. 25c
14 Plate—55-60 MMFD. 27c
27 Plate—100-110 MMFD. .. 45c
37 Plate—150 MMFD. 50c
38 Plate—150-155 MMFD. .. 55c
53 Plate—210-21 MMFD. 60c

Lock Type Air Trimmer Variable Condensers
3 Plate—12-15 MMFD. 10c
5 Plate—20 MMFD. 11c
8 Plate—30-35 MMFD. 13c
10 Plate—40 MMFD. 14c
13 Plate—50 MMFD. 17c
14 Plate—56 MMFD. 20c
20 Plate—80-100 MMFD. ... 25c
27 Plate—100-110 MMFD. 35c

3 GANG T.R.F. VARIABLE CONDENSERS .000365 Cap 95c
D. P. D. T. SLIDE T O G G L E SWITCH 23c

H. & H. S.P.S.T. T O G G L E SWITCHES— 8 for $1.00

AMPHENOL
2 piece 4-pole . . . Male and Female Separable plug. Male is for panel mount. Female for Flex. cord. A steal, at only... 35c per pr.

SIGNAL CORP TRANS. KEYS 49c
4 PRONG WAFER SOCKETS—$1.49 per C; 3c each
ISOLANTITE OCTAL WAFER SOCKETS— $4.25 per C ..... 6c each
ISOLANTITE UNDER PANEL CLAMP SOCKETS— $4.50 per C ..... 5c each
PHILCO 4 MF—300 V—1⅜" CAN CONDENSER— $8.00 per C ..... 10c each
W-L—10 W. 1,000 ohm POWER RHEOSTAT 29c ea.
5-6 PRONG WAFER BAKELITE SOCKETS— $2.50 per C
100 ASST. SOCKETS—4-5-6-7—OCTAL $3.50 per C
I R C—1,000 OHM WIRE WOUND POTENT ... 15c
30 HY-FILTER CHOKE SHIELDED 49c
UNSHIELDED 39c
100 ALLEN BRADLEY — 1 WATT — ½ MEG RESIS. $1.25
100 ERIE—1 WATT—2,000 OHM RESIS. $1.15
10 WIRE WOUND RES. KIT—5-50 W. ASST. 49c
2 METER RF CHOKES 7c
phono PICK-UP REST. RUBBER—1 HOLE MTG. 6c
YAXLEY 2,000 OHM WIRE WOUND RHEOSTATS ..... $1.00 per doz.
RCA-VICTOR NEEDLE CAPS—2 PIECE TOP & BOTTOM ..... 10c ea.
CARTER WIRE WOUND C.T. VARIABLE 20 OHM RECTIFIERS ..... $1.00 per doz.
G. E. TAPPED VOLTAGE DIVIDER—200 WATT—230 OHM — MOUNTED ON ASBESTOS BASE — TAPPED AT 180-205 ohms 25c
RCA 6 OHM POWER RHEOSTATS 39c
RCA RUNNING BOARD AUTO AERIAL 49c
PHILCO AUTO SUPPRESSORS—$5.00 per C; 7c ea.

3 BAND RADIO SET CHASSIS short wave continuous to broadcast. These chassis are incomplete. Manufacturer started them, went bankrupt. Chassis has variable condenser, filters, 6 tube super-het, all filament wiring complete. By-pass condensers, resistor, padders, band-changing switch, tone control, volume control, all wired ready, less transformers less IF (IF 50c each, extra). This is for straight AC; may be converted for AC-DC.
Limited quantities only ..... **$2.50** each

6 TUBE 3 BAND AC-DC CHASSIS complete with filter condensers, volume control, dial drive, tone control, band switch, by-pass condensers, resistors, sockets, all wired ready for use with phone attachment (IF 50c each, extra) **$2.00**

Signal Corps Flex, hook-up wire asst. contains approx. 150 ft. asst. colors, glass insulation. 1 lb. **25c**

GENERAL ELECTRIC 60 CYCLE WATT HOUR METERS, slightly used, perfect condition, same as used in your home. 110-125 volts. 5 Ampere **$3.50** 10 Apm. ..... **$4.50**; Glass enclosed **$1.00** extra

PHILCO MAGNETIC RELAY TAP SWITCH. Operates on 6 V DC — 15 V AC. When contact is made relay operates rotary contacts switch to 20 different contacts. Brand new **89c**

Philco rotary tap tone control, 3 position, including condensers. Only 1 wire to connect to grid of audio tube. ¼" shaft **25c**

Oil-filled by-pass condenser asst. removed from govt. apparatus — electrically perfect, dual 1-600 volt — .5-600 volt. 25 piece asst. **$1.00**

I. C. A. 30 MH RF choke **25c**

Television or Oscilloscope power transformer for use up to 5" tubes. 117 V. pri.-60 cy. 1-2½ V-25 amp., 2-5 V 2 amp., 1-470 V-10 Ma. 1—750 V-CT—60 Ma. **$2.95**

Grind your own crystals—Pure Brazilian Quartz, all sizes and thicknesses—½ lb. package **$1.00**

National Velvet Vernier Dial Attachment — ¼" shaft — converts any dial to slow motion vernier **75c**

340 degree dial with 10 push button attachment—¼" shaft—ideal for Xmitters—Sig Gen. or Osc. **49c**

Yaxley Band Switches—
3 gang 3 posit. 3 band **30c**
5 gang 5 posit. 4-5 band **40c**

Trimmer-Padder Asst.—all isolantite—singles, dual, tripies—100 asst. pieces **$2.25**

Signal Corps V. T. I receiving tubes—$1.00 per doz.

Walkie-Talkie Telescoping Aerials—extends 36" **75c**

MAGNAVOX—
12"— 1000 ohm Dynamic speakers **$3.95**
8"—10,000 ohm **1.35**

P. A. System wall speaker box. 8" diameter covering screen grille for hospital, factory or school installation. Will take up to 6" speakers. Each ..... **35c** Lots of 25, each **25c**

Radio Hardware, nuts, bolts 632-832 solid brass cadmium plated—$7.00 value. 4 lbs. for **$1.00**

Spaghetti Assortment **75c**

30-WATT — 6L6 BEAM POWER AMPLIFIER KIT. COMPLETE KIT OF PARTS WITH ALL NECESSARY PARTS-TUBES — READY TO ASSEMBLE AND WIRE — NOTHING ELSE TO BUY — BUT SPEAKER AND MIKE. CHASSIS — 20" LONG x 8¾" WIDE—5" HIGH CADMIUM PLATED STEEL EXTRA HEAVY. PLATE SUPPLY—IS PROVIDED BY AN OVERSIZE EXTRA HEAVY TRANSFORMER 6" x 4½" x 4"— (1) FILAMENT SUPPLIED BY AN EXTRA HEAVY TRANSFORMER FILTER. BY PASS AND FILTER CONDENSERS, SOCKETS ALL READY MOUNTED ON CHASSIS. VOLUME AND TONE CONTROLS WITH SEPARATE AC SWITCH ARE PROVIDED. CIRCUIT IS THE LATEST TYPE OF PHASE INVERTER SYSTEM USING 1-5U4, 2-6L6, 1-6C5, 1-6SJ7, 1-6N7. CHASSIS HAS AMPLE ROOM TO WORK ON OR ADD MORE TUBES-TERMINAL STRIPS FOR MOUNTING RESISTORS, ETC. ARE ALSO PROVIDED, AND ALL PARTS ARE SIGNAL CORPS SPEC. BRAND NEW, NEVER USED BEFORE. A LARGE PICTORIAL DIAGRAM IS PROVIDED SO THAT A NOVICE MAY BE ABLE TO ASSEMBLE THIS KIT WITH EASE, MERELY BY FOLLOWING THE POINT TO POINT CONNECTIONS THAT ARE OULINED ON THE PRINT. COMPLETE 6L6 KIT, LESS SPEAKER $18.95

TUBES—6SN7—**45c**; 54—**39c**; 2A7—**39c**; 55—**39c**; 117L7 — **59c**; 27 — **25c**; #15, same as #224 — **20c**.
DRY ELEC. FILTER COND. ASST. CONTAINS 10 PIECES ALL BRAND NEW 150-450V **$1.10**
6 ASST. WET ELECTROLYTIC CONDENSERS **59c**

RADIO EXPERIMENTER'S SURPRISE PACKAGE —CONTAINS BY PASS & FILTER CONDENSERS, SHORT WAVE TUNING UNITS, POWER AND AUDIO TRANSFORMERS, SOCKETS, RESISTORS, CHASSIS HARDWARE, OVER 15 LBS. OF VALUABLE PARTS $4.95

MINIMUM ORDER $2.00—NO C.O.D. SHIPMENTS—PLEASE INCLUDE POSTAGE
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LARGEST WAR SURPLUS STORE IN AMERICA

METER BARGAIN BUYS!

Dejur model 210 0-2MADC 2½" round 2.95
Westing RX-35 0-1 MADC 3" sq. 4.95
Weston 476 0-150 VAC 3½" ... 4.95
Roller-Smith MB34W 0-150 VAC 3½" round 4.95
Weston 506 (blk. face) 0-200 MADC 3½" round 2.95
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INVERTER PE218-C 19.95

Input 28 volts. Exciting voltage 28 v. Output 115 VAC at 1500 watts. 1 phase, 400 cycles. Complete with starting relays, filter and mounting bracket. New.

Dynamotor DM32

For 274 N Receiver. Input 28 VDC. Output 250 VDC at 60 mils. Now 95c

DYNAMOTOR DM33A

28 volts output 575 V, 160 mils. For 274 N modulator 1.95

DYNAMOTOR BD-AR

Input 28 VDC, output 375 volts, 150 mils with hash filter & mounting bracket. New 1.95

DM 28—For BC 348 Receiver 95c

1147 B U.H.F. SUPERHET RECEIVER

Frequency 100 to 160 megacycles contains 7 tubes — some lokal type, some octal, 2 gang butterfly condensers, single dial control, less power supply 4.95

5 assorted DYNAMOTORS (less filters) 3.00

DYNAMOTOR BD 77C 6.95

Input 14 volts, output 1000 V at 350 mils. Comp. with mounting bracket, hash filter and solenoid starting relay.

PE 73 C—Input 28 volts, output 1000 V at 350 mils. Comp. with mounting bracket, hash filter, and solenoid starting relay. New. 4.95

BC 375 TUNING UNITS

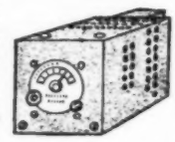
TU-6B, TU-5B, TU-7B, TU-8B, TU-9B, TU-10B, TU-26B. Will ship no. indicated 'til sold out, then nearest no. sent.

(without cases) 1.75 5 for 8.25

(with cases) 2.25 5 for 10.95

BK 22 RELAY BLOCK, 95c

BEACON RECEIVER 1206B



Six tube superhet. 200 to 400 kilocycles.

3.95

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TO ANYONE ANYTIME instantly with "Inter-Talkie" the new Lowest Cost talking system. No Tubes—No Electric Plug-ins Needed! Simple to install Yourself — Takes Only A Few Minutes! Most Beautiful Design! Real loudspeaker volume—No Phones—radio, buzzers, lights—bells—howls—hum or trouble! Always ready to use. Sets On Desk or Hangs on Wall! Average Yearly Cost 50c.

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SELENIUM RECTIFIERS

FULL WAVE BRIDGE TYPES

Input	Output	Current	Price
From 0-18 V.A.C.	From 0-14 V.D.C.	1 AMP.	$2.49
0-18 V.A.C.	0-14 V.D.C.	3 AMP.	3.49
0-18 V.A.C.	0-14 V.D.C.	5 AMP.	4.95
0-18 V.A.C.	0-14 V.D.C.	10 AMP.	7.95
0-18 V.A.C.	0-14 V.D.C.	15 AMP.	10.95
0-18 V.A.C.	0-14 V.D.C.	20 AMP.	13.95
0-18 V.A.C.	0-14 V.D.C.	30 AMP.	19.95

Input	Output	Current	Price
From 0-36 V.A.C.	From 0-28 V.D.C.	150 MA	$1.25
0-36 V.A.C.	0-28 V.D.C.	2 AMP.	4.95
0-36 V.A.C.	0-28 V.D.C.	5 AMP.	7.95
0-36 V.A.C.	0-28 V.D.C.	10 AMP.	13.95
0-36 V.A.C.	0-28 V.D.C.	15 AMP.	19.95
0-36 V.A.C.	0-28 V.D.C.	20 AMP.	25.95
From 0-120 V.A.C.	From 0-100 V.D.C.	2 AMP.	14.95
0-120 V.A.C.	0-100 V.D.C.	2 AMP.	19.95

HALF WAVE TYPES*

Input	Output	Current	Price
From 0-18 V.A.C.	From 0-7 V.D.C.	3 AMP.	$2.25
0-18 V.A.C.	0-7 V.D.C.	5 AMP.	2.95
0-18 V.A.C.	0-7 V.D.C.	10 AMP.	4.95
0-18 V.A.C.	0-7 V.D.C.	15 AMP.	6.95
0-18 V.A.C.	0-7 V.D.C.	20 AMP.	8.95
0-18 V.A.C.	0-7 V.D.C.	25 AMP.	10.95

Input	Output	Current	Price
From 0-36 V.A.C.	From 0-14 V.D.C.	3 AMP.	$2.95
0-36 V.A.C.	0-14 V.D.C.	5 AMP.	4.95
0-36 V.A.C.	0-14 V.D.C.	10 AMP.	7.95
0-36 V.A.C.	0-14 V.D.C.	15 AMP.	10.95
0-36 V.A.C.	0-14 V.D.C.	20 AMP.	13.95
0-36 V.A.C.	0-14 V.D.C.	25 AMP.	16.95

*Use with capacitor to obtain any voltage up to twice rated output.

RAYTHEON RECTIFIER CHOKES

.03 Henry at two amperes $2.25
.02 Henry at five amperes 3.25

CAPACITORS

1000 MFD., 15 V.D.C. 98c
3000 MFD., 35 V.D.C. $2.45
100 MFD., 350 V.D.C. 1.69

FULL WAVE BRIDGE RECTIFIER TRANSFORMERS

PRIMARY	SECONDARY	TO DELIVER	CURRENT	PRICE
115 V.A.C. 60 cy.	10 V.A.C.	7 V.D.C.	18 AMP.	$3.75
115 V.A.C. 60 cy.	15 V.A.C.	12 V.D.C.	12 AMP.	3.75

To obtain 24 V.D.C. at 12 AMPS., Use two 15 V.A.C. Transformers in series

It would be impossible to give a complete listing of all our rectifier types. Our engineering staff is at your service to help you work out the application of selenium rectifiers to your specific problems. Write us for quotations or further information on capacitors and transformers to be used in conjunction with selenium rectifiers.

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on all bands yet requires no oscillator or multiplier tuning. Because of its compact size the TBS-50 may be used for either fixed station or mobile operation.

As an exciter unit, the r.f. output is capable of driving a 1000 watt Class C amplifier, the separate winding on the modulation transformer permits the audio system to be used to drive a 500 watt modulator. The TBS-50 employs a pi antenna, matching the network. There is a separate coaxial output terminal for 144-148 mc. antenna.

The power input to the final is 50 watts with 450 volt power supply on bands 1 through 7 and 30 watts on band 8. The unit has a 6AQ5 crystal oscillator, a 6AQ5 buffer-multiplier, an 807 final amplifier and two 616 Class B modulators. The entire transmitter is housed in a steel cabinet measuring 8"x12"x8".

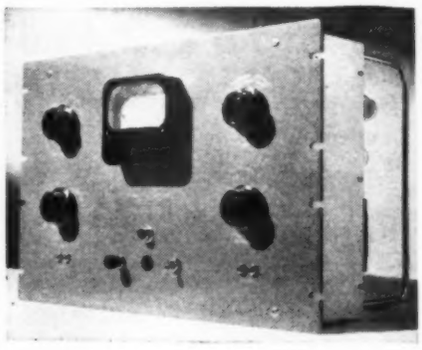
For complete information and literature on the TBS-50 write directly to *Harvey-Wells Electronics, Inc.*, Southbridge, Massachusetts.

DYNAMIC NOISE SUPPRESSOR

Herman Hosmer Scott, Inc. has developed a new and improved model of the *Scott* Dynamic Noise Suppressor, the Type 910-C.

Designed to allow broadcast stations to transmit recorded music with a wide frequency range and greatly reduced background noise, this new unit functions on the exclusive dynamic bandpass principle which is inherently distortion free.

Compared with previous models, the new type features improved control circuits, extended frequency range, a continuous suppression control, and more flexible remote control facilities.



Complete specifications on the Type 910-C are available from Dept. RN, *Herman Hosmer Scott, Inc.*, 385 Putnam Avenue, Cambridge, Massachusetts.

"VIDEAMP"

Crystal Devices Co. has announced the "Videamp", a new 13-channel, two-stage preamplifier for television receivers. The unit is self-powered and provides a gain of 10 or better on all 13 channels, according to the company.

With this new unit sets can be operated in the primary service area with

ESSE Specials!

Do not fail to closely examine this list of bargains. We believe that every item listed below is a sensational value. All equipment advertised herein is unconditionally guaranteed to the customer's satisfaction to this extent: Return any item advertised within five days after delivery for full refund except transportation charges (both ways).

Filter condenser, G.E. Pyranol, oil filled 8 MFD @ 1000 volts DC working voltage about 1⅝"x4"x5" high, shipping weight about 3 lbs. Brown porcelain stand off insulator terminals. New $2.00.

Filter condenser, Sprague, oil filled, 8 MFD @ 1000 volts DC working voltage size about 1"x4"x5" high, shipping weight about 2 lbs. New $2.00.

Filter condenser, 8 MFD @ 700 volts DC working voltage, Oil filled, well insulated terminals. Size about 2"x4½"x5" high, with mounting flanges, gray metal case shipping weight about 4 lbs. New $1.25.

Filter condenser Cornell Dubilier, 1 MFD @ 4000 volts DC working voltage, oil filled. Size about 2¼"x4"x7" high over all. Shipping weight about 4 lbs. Heavy stand-off insulator type terminals. New $3.75.

Transformer, 110 volts 60 cycle input; output being two secondaries—each giving 14 volts @ 11 amperes, which can be used alone, in parallel, or in series for various voltage and current combinations. Size about 3½"x3½"x4" high. Ideal for operation of propeller pitch motors used for beam antenna rotation. Shipping weight 7 lbs. Manufactured for "Esse Radio Company" brand new $5.95.

Transformer, for use on 110 volt 60 cycle primary line; secondary giving 28 volts, center tapped, @ 11 amperes, auto-transformer type of winding, size 3½"x3½"x4" high, shipping weight 7 lbs. made for "Esse" new $4.95.

Condenser, electrolytic, 100 MFD. @ 300 volts, 2½" diameter, 4½" high, metal can, shipping weight 2 lbs., brand new $2.00

Filter condenser, Tobe, oil filled, 1 MFD @ 600 volts DC working voltage, size about 1"x1"x2½" high, new 20c.

Condenser, bath tub type .1 MFD @ 1000 volts DC, new 20c.

Condenser, Tobe, oil filled, 3 x .1 MFD @ 600 volts DC at 25c.

Filter condenser, Aerovox, oil filled, 2 MFD @ 600 DC working volts size about 1½"x1½"-x5" high, shipping weight about 1 lb., new 35c.

Condenser, Cornell-Dubilier, oil filled, 4 MFD @ 1000 volts DC working voltage, size about 1"x2½"x5" high, shipping weight 2 lbs., new $1.75.

Condenser, mica, .25 MFD @ 250 volts, new 15c.

Jack Box BC-631-B, size about 2"x2"x4", aluminum case, contains 10,000 ohm volume control knob, Jones Barrier strip, brand new 40c.

Switch, push-button type DPST on/off type, to fit standard switch box, 10 amperes @ 250 volts, new 25c.

Micro-switch completely standard, metal grate well cast rated 15 amperes @ 115 volts normally open type, plunger has override feature. New 35c.

Vibrator, Radiart VS-3, for 6 volt battery operation, used in vibrator supply PE104—which is used with BC654A transmitter-receiver. Type J-4, new $1.95.

Vibrator, Radiart VS-3 for 6 volt battery operation, used in vibrator supply PE104—which is used with BC654A transmitter-receiver. Type J6 (probably exactly the same as (A), new $1.95.

Relay, 110 volt 60 cycle AC plunger type for interlock, new 85c.
Lord Shock Mount, heavy duty type, base size 3" square x 1½" high—⅜" diameter bolt may be used. New 35c.

HAND SET T-S-10-G—Sound powered telephone. No batteries required for operation: connect to any two wire fence, wire fence in ground, etc., by convenient clips included. $9.50
Price each $9.50
Per Set $17.50

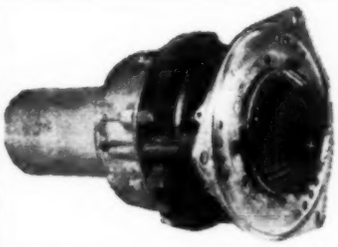
RADIO MODULATOR

BC-424, made by Westinghouse, 110 volt, 60 cycle AC operated. Size 9" x 14" x 9" high, weight about 30 lbs. packed. Has National Velvet Vernier Dial. Thordarson power transformer and chokes, tubes used and included are: 6F6, 6J7, 6J7, 5W4 and 955. Frequency about 190 megacycles. Comes with heavy steel case..... $22.50

RELAYS

ALL BRAND NEW

RBM DPDT 110v 60 cycle, make before break	.75
Relay, 6 MA 5000 ohm DC resistance, SPDT	.85
Leach type 1127-FR 110v 60 cycle DPST	1.50
Automatic Electric Co. DPDT 24v DC 6 amp silver tungsten contacts	.40
Automatic Electric Co. Delay relay, 20 ohm, silver tungsten contacts	.40
Starter relay, 28 volt operated, heavy duty construction	.50
Switch, pushbutton type DPST on/off type, to fit standard switchbox, 10 amps at 250 volts	.25
Switch, toggle type, bat handle, DPDT heavy duty contacts	.35
Leaf type switch, 4 poles, single throw, single hole mounting	.25



BEAM ROTATING MOTOR as shown $12.95

METERS

BRAND NEW AND ALL CHECKED FOR ACCURACY

0-500 MA DC 3½" round NX35 Westinghouse	$3.00
0-5 Amps RF 3½" round NT35 Westinghouse, Internal TC	4.50
0-3 Amps RF 2½" round NT33 Westinghouse, less TC	3.50
0-10 & 0-250 MA DC combination round NX33 Westinghouse	2.50
0-10 & 0-250 MA DC combination round DW41 G.E.	2.50
0-2 volts full scale 2000 ohms/volt Volume Level meter, Westinghouse, round 2½"	3.00
0-100 MA DC 2½" round MD20001 McClintock	2.50
0-3 MA DC 3½" square 327A Tripplett	4.50
0-500 Volts AC 3½" square 337A Tripplett	6.00
C-2 Volts AC rectifier type 10,000 ohms/volt 327A Tripplett 3½" square	15.00
0-50 MA AC 337A Tripplett 3½" square	7.50
0-30 amps AC 3½" round case, 331JP Tripplett	6.00

Dual volume control wire wound, each section 2500 ohms, new 35c.

Toggle switch, bat handle, DPDT, new 30c.

I. F. Transformer, 19.2 megacycles, slug-tuned, New 15c ea.

Microphone transformer, Ouncer type, for carbon mike to tube grid, circuit printed on case. New 50c.

Transformer, two sets of windings each 1 to 1 ratio, good for frequencies of 1000 CPS and higher. New 25c.

Filter Choke, 19 henry 105 MA DC, resistance 170 ohms, metal cased, size about 3"x3"x4" high. New $1.50.

Neon tube clear glass about ⅛" O.D. overall length about 11" excellent for transmitter RF tuning indicator. New 40c.

Microswitch, completely weather-proofed, metal-clad or cased, rated 15 amps at 115 volts, normally open type, plunger has override feature, New 35c.

Battery type BA-38, 103.5 volts, used in Handie-Talkie, Mine detectors, or for any purpose where low current drain is required. Size 1"x1"x11½" long. Out-dated, but tests O.K. New $3.00.

Tube socket, RCA, for 866 or similar type tube bases. New 35c.

Tube socket, wafer octal type, excellent mica insulation. New 10c.

Tube socket for 813 type tube, Johnson type 237. New 60c.

Tube socket, for Acorn type tuubes, made by Millen Co. New 20c.

Tube socket, porcelain octal type, less mounting ring. New 10c.

Cord CD-132, has PL-55 type plug and 9" cord, with spade type lug tips 35c.

Sylvania type 1N26 crystal 35c.

Resistor 20 watt, one-half ohm, 10c.

Fuse holder for type 3AG fuses, 10c.

Amphenol co-axial chassis connector, new, type 83-1B, 40c.

Amphenol co-axial junction connector, new, type 83-1J, 40c.

Amphenol co-axial angle plug adapter, used, type 83-1AP, 40c.

Connector, bakelite insulation, male and female section, 6 pin polarized, 00c.

Canvas bag, moisture & fungus proofed, with carrying strap, leather re-enforced corners, weight 3 lbs., size 9"x14"x12" high. Ideal for tool case, for sportsmen, etc., $1.00.

First IF transformer for BC348 type receiver, 915 kilocycles. New $1.00.

Ohmite tap switch, model 111, 9 taps, non-shorting, will handle 10 amps at 115 volts. New 35c.

Kit of potentiometers, twenty-five assorted sizes carbon and wire-wound, New $2.25.

Resistor, voltmeter multiplier type, rated at 2 megohms 2 kilovolts insulation, 1 MA maximum current, about 1" diameter x 5½" long, mounts in clips. New 75c.

Resistor, 100 watt type, 5 sections having 7500, 3000, 23, 23 and 750 ohms (total of 11,269 ohms) resistance. 1¼" diameter by 8½" long. New 35c.

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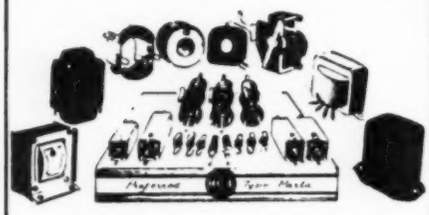
R.C.A. TELEVISION KIT



Now, for the first time you are offered a basic kit consisting of the finest essential components *enabling you to build anything from a 7" to a 20" Television Receiver.* These parts are the best the industry has to offer—All genuine R.C.A. Also included is a schematic diagram and a complete parts list of the minor components necessary to make up a complete TV receiver. Described and pictured below are the various components included in this sensational kit.

KIT CONSISTS OF:

- Deflection Yoke Type 201D1
- Width Control Type 201R1
- Horizontal Linearity Control Type 201R3
- Power Transformer Type 201T6
- Yoke Mounting Hood Type 201X1
- Focus Coil Type 202D1
- Vertical Output Transformer Type 204T2
- Filament Choke Type 204L1
- Television I.F. and Video Coil Kit Type 204X2
- Vert. Blocking-Oscillator Transformer Type 208T2
- Horiz. Blocking-Oscillator Transformer Type 208T3
- Horiz. Output Transformer Type 211T1

$69.50 COMPLETE

The parts in this kit, if purchased separately, would list at over $150.00. Niagara saves you over 50%, or a big $81.20. GET YOURS TODAY.

RADIO MAN'S SPECIAL

5" or 7" TELEVISION FOUNDATION KIT

Here is one of the biggest bargains ever offered in Television Foundation Kits.

This TELEVISION FOUNDATION KIT consists of the most essential (and expensive) parts needed in constructing a television receiver. Starting with the hi. volt. power supply, for the scope, right through to the antenna. This kit contains: high voltage scope transformer (for 5" or 7" tube), 2x2 filament transformer, lo. volt. transformer for receiver, cathode ray filament transformer, filter choke, 6.3 filament transformer for 16 six volt tubes along with five volt transformer for the 5U4, the two hi. volt filter condensers, blocking oscl., transformer for all RF's sound and video IF's, peaking coils and discriminator transformer. The rectifier tubes 2x2 and 5U4, the picture tube 5BP4, and an all aluminum dipole antenna are also included.

A 26 page instruction book, including a large 12 by 18 schematic diagram, theory of television, circuit functions, explanation of scanning, preliminary volt. measurements, parts lay-out and final adjustment of the television receiver which facilitates easy alignment without the use of elaborate test equipment comes with each unit.

If you are a radio man you will probably have all of the minor parts not included in this foundation kit. By following the simple schematic diagram and instructions you can thus build a television receiver at many dollars savings.

The above kit with parts as mentioned	$34.75
The above kit with 7EP4 for an additional	12.95
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Completely punched chassis for above kit	5.50

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simple indoor antenna equipment. For receivers located in excess of 100 miles from the transmitter, this accessory is is said to provide adequate video reception.

The equipment is shipped from the factory to match 300 ohm input and outputs but provision is made for any other input or set impedance values by adding resistive components at installation terminals.

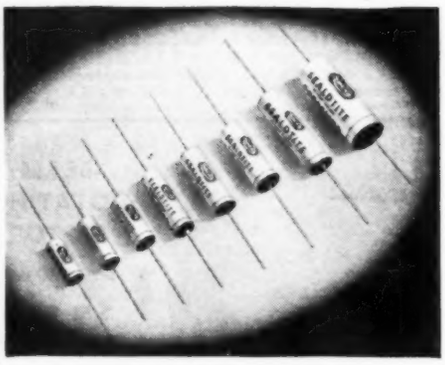
Additional information on the "Videamp" may be secured from Dept. RN, *Crystal Devices Co.*, 1819 Broadway, New York 23, New York.

"HI-TEMP" TUBULARS

Two new types of all-purpose capacitors are now being mass-produced by *Solar Manufacturing Corporation* at the company's North Bergen, New Jersey plant.

Known as the ST and STM, the new units are plastic-encased and of molded paper construction. The "Hi-Temp" plastic molding compound which encases these units is heat-resistant to 100 degrees C and is exceptionally resistant to penetration by atmospheric moisture, requiring no wax or varnish outer impregnation for surface sealing.

These "Sealdtite" units are available with either mineral oil or Halowax impregnated sections to fit application requirements for all types of personal, home, and automobile radios.



A descriptive bulletin is available from *Solar Manufacturing Corporation*, 1445 Hudson Boulevard, North Bergen, New Jersey.

D.C. CONVERTER

Special converters which have been designed to permit persons in direct current metropolitan areas to have television receivers in their homes or offices have been announced by *Electronic Laboratories, Inc.* of Indianapolis.

Two models of converters are available, the Model No. 11OR15 for operating table model television receivers, and the Model No. 11OR30 for operating console units.

No special wiring is required for the converters which operate with a new-type automatic remote starting system. The unit for table models weighs 15 pounds while the converter for the console weighs 55 pounds. Either converter may also be used for wire recorders, juke boxes, radio-phonograph combinations, and office dictating machines.

Further data on these two converters may be obtained from *Electronic Laboratories, Inc.*, Indianapolis, Indiana.

—30—

Pilotuner

(*Continued from page* 59)

capacities mentioned. With the values shown in the diagram and keeping the wiring capacities at a minimum by following the arrangement as shown in the illustrations, it will be found that the high frequency response will be down 3 db., to the half-power point, at about 13.26 mc. and will still be flat at 85% of this, or 11.27 mc.

The low frequency response will depend partly on the reactance of the cathode and screen bypass condensers giving, in effect, degeneration and less gain in the stage as the reactance increases. At 10 mc. the values used will have a reactance of approximately 16 ohms and at 1 mc. this will be about 160 ohms. The low frequency response is also dependent on the coupling condenser and the grid resistor of the following stage. Roughly, the low frequency response will not fall off to an appreciable degree for sine waves if the time constant, or *RC* product, of this combination is equal to the period of the lowest frequency desired. This can also be thought of as a voltage divider, with the reactance of the condenser increasing as the frequency decreases.

The gain of the stage will be essentially GmR_1 at 10.7 mc. The GmR_1 of the 6AK5 tube used with the voltages available in the *Pilotuner* measured about 5000 micromhos. This will give a gain for the stage of approximately 12 which is entirely sufficient to give satisfactory output, even in such a poor location as mine.

In wiring the circuit most of the parts are wired directly to the tube socket and then set in place as an assembly. The socket used is an *Eby* or *Amphenol* 7-pin miniature ceramic socket with a shield base extending about 11/16 of an inch. The shield itself is not used. Use pin 3 as ground and run the 150 ohm cathode resistor from pin 2 to pin 3 and the .001 mfd. cathode condenser from pin 7 to pin 3. The .01 mfd. screen bypass condenser will go from pin 6 to pin 3 and a piece of No. 18 bus wire will also be soldered to pin 3 for the ground connection and to help hold the assembly in place.

The 12,000 ohm resistor and the 50 microhenry choke are paralleled and soldered to pin 5. At the opposite end of this, a junction is made with the .0015 mfd. coupling condenser and the 2400

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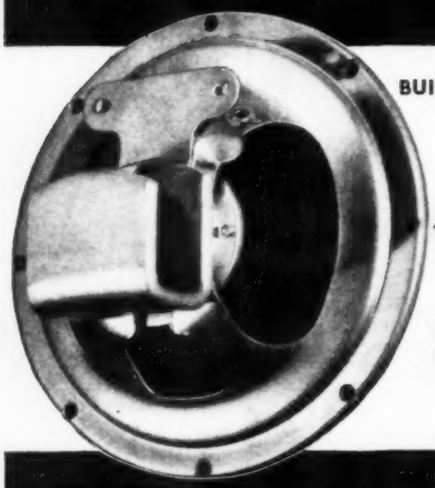

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ohm load resistor. The 25 microhenry choke follows this and joins the 1000 ohm decoupling resistor and a lead from pin 6 for the screen voltage. With an insulated wire soldered to pin 4 for the filament supply and another to the free end of the 1000 ohm resistor, unless the resistor lead itself is long enough, for the "B plus" connection, the assembly is ready to place in the chassis.

From the i.f. transformer feeding the last 6BA6 tube in the *Pilotuner* remove the .0015 mfd. condenser and the 100,000 ohm resistor. The other end of the condenser should be removed from the ground stud as well and may be used as the coupling condenser for the added stage. Ground the terminal just vacated on the i.f. transformer to the stud above. Remove the wire between the i.f. transformer and the 6BA6 grid, pin 1, at the grid end only and solder the end of the 100,000 ohm resistor which was detached from the i.f. transformer to the 6BA6 No. 1 pin.

Now take the end of the wire from the i.f. transformer which formerly went to pin 1 of the 6BA6 and solder this to pin 1 of the 6AK5 assembly. Set the tube in the chassis as shown in the photograph and solder the wire from pin 4 of the assembly to pin 4 of the 6BA6, keeping this wire close to the chassis and away from other parts of the circuit. The wire from pin 3 of the assembly can be conveniently soldered to one of the ears of the filter condenser can.

Next the coupling condenser which was removed from the *Pilotuner* is soldered to pin 1 of the 6BA6 and the junction previously mentioned on the 6AK5 assembly. Now solder the "B plus" wire from the 1000 ohm resistor to the "B plus" point on the ratio detector transformer and arrange the added tube in the empty chassis space between the oscillator coil and the filter condenser, keeping it as far away from the coil as possible.

The changes described enabled me to use one less stage in my audio amplifier to which the tuner is connected and provided tuning ease comparable to narrow-band AM. The warm-up time of the *Pilotuner* was slightly greater but the minor drifting was no longer objectionable, suggesting that it may have been due in part to inaccurate tuning. The FM station that was mentioned as being behind some hills could now be received and the tonal balance of the whole combination seemed richer than before.

The striped wire shown in the illustrations in the corner of the chassis behind the ratio detector connections is not in the original *Pilotuner*. It goes from the switch to the audio output and was added for the following reason.

In wiring the *Pilotuner* to my audio amplifier I originally ran the audio out-

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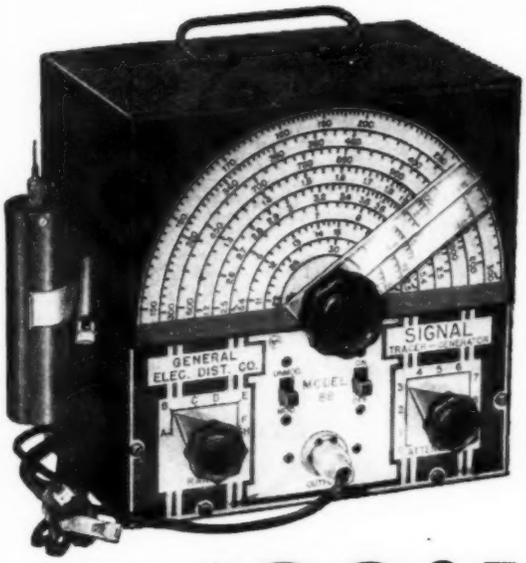

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put direct to a grid which was left connected when the amplifier was used as a phonograph. This connection was not made as *Pilot* shows in their book as I am using a coil type pick-up and not a crystal. With the audio amplifier connected for phono and the audio output from the *Pilotuner* unchanged, the *Pilotuner* output condenser was close enough to the transformer and the 60 cycle wiring to pick up a noticeable hum.

This hum disappeared when using the *Pilotuner* due to their method of balancing out the supply voltage pickup. However, I changed the condenser connection to the switch and made the audio output wire shielded from the switch so the hum could not be picked up when the *Pilotuner* was turned off and the amplifier was used for phono.

Since then I have changed the input and switching in my amplifier so this hum pickup would no longer be a problem even with the original *Pilotuner* wiring. —30—

Phono Amplifier
(*Continued from page* 45)

secured by screws to the bakelite, were used to mount the amplifier, and the use of the screws as tiepoints in the circuit wiring was carefully avoided.

The record player to which this amplifier was applied is an *RCA* model PRP-1 which was in popular use before the war. A two-inch speaker was mounted in the cabinet in the open location immediately in front of the bushing that mounts the pickup arm.

—30—

E. J. Biesekerski was one of two Eastern Air Lines' employees to be awarded membership in the DX Century Club. A foreman in the carburetor shop at the Eastern Air Lines Base in Miami, he has received confirmation cards from 110 countries since becoming a ham in 1930. He has talked with amateurs in 139 foreign countries but 29 failed to send confirmation cards. His call is W4KA. R. J. Miller, the assistant chief of the operating section of the company's Communication Dept., has contacted 129 countries and received confirmation from 107.

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Television Scope

(*Continued from page* 55)

insulated mounting wafers are provided with each condenser. These condensers should be covered by a suitable cardboard tubing or by tape in order to protect the user from a substantial "jolt" which would result from touching the metal cans and the chassis at the same time.

Next to the various power supply components and directly behind the cathode-ray tube will be noted, in the photograph in Fig. 1, a bakelite terminal strip. On this terminal strip are mounted the two centering controls, R_{25} and R_{24}, plus several other components associated with the cathode-ray tube itself, principally R_{29}, R_{30}, R_{26}, R_{28}, R_{27}, R_{23}, C_{24}, and C_{26}. By arranging these parts in this fashion the components associated with the cathode-ray tube are convenient for wiring to its socket, the centering controls which carry high voltage are insulated from the panel and chassis, and much wiring from top to bottom of the chassis is saved. It is suggested that this terminal board be laid out and wired before being mounted in place.

Actual wiring of the oscilloscope should start with the power supply, following the wiring and mounting of the above-mentioned terminal board. When this is completed, the three rectifier tubes V_{10}, V_{11}, and V_{12}, should be put in place, the power supply turned on and the output voltages measured. If operating correctly the voltage at the junction of C_{47} and CH_1 should be about 800 volts plus with respect to the chassis, and the voltage at the plates of V_{12} should be about 425 volts minus.

When it has been determined that the power supply is operating correctly, the "Focus" control, R_{32}, and the "Intensity" control, R_{34}, should be wired into the circuit together with the terminal board previously described and the socket of the cathode-ray tube itself. A good grade of high voltage hookup wire should be used for the high voltage circuits associated with the power supply and cathode-ray tube to prevent any possibility of arc-over. One of the smaller types of automobile ignition wire is preferred by the author.

Probably the most important test to be made during the entire construction of this oscilloscope occurs at this point. This consists of testing the actual operation of the cathode-ray tube in conjunction with its power supply. The object of the test is to secure a very *small round spot* of light on the cathode-ray tube screen which can be properly focused and brightened with the appropriate controls, and also moved nearly the full distance across the screen both

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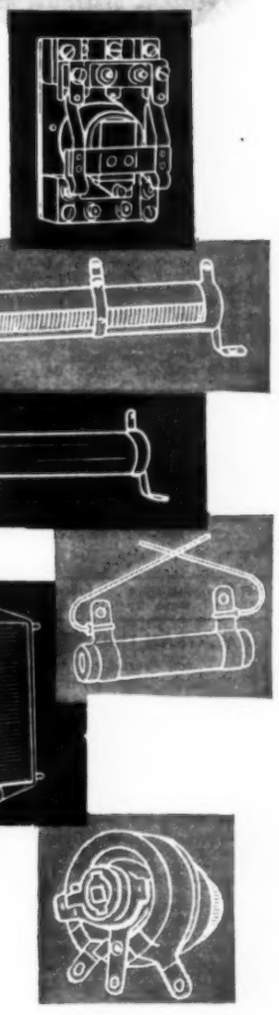

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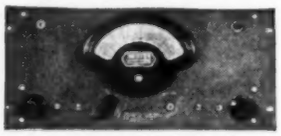

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horizontally and vertically by means of the centering controls. Emphasis is placed on the words *small round spot* since the principal source of trouble at this point may be magnetic interference from the power transformer. If such a disturbance is present, it will show up as an elongation of the cathode-ray tube spot, or even may appear as a small circle instead of the desired *small round spot*.

Two means of remedying these magnetic disturbances are available, namely, shielding the cathode-ray tube, magnetically, and shielding and/or altering the position of the power transformer. If the disturbance is small, causing the spot to be deflected only a small amount —say ⅛ inch or less—the difficulty can usually be remedied by placing a commercial cathode-ray tube shield or piece of iron pipe—the thicker the metal wall the better—around the neck of the tube. In general, this tubing should fit as close to the outside diameter of the tube's neck as possible. More stubborn cases may require more than one piece of tubing located coaxially around the neck of the tube. A combination that frequently does the trick is one piece of close fitting iron pipe around the tube's neck and a second much larger piece to shield the entire tube. Extremely troublesome cases may require that the power transformer be shielded and/or rotated or altered in its position, but this is unlikely if the transformer is mounted as previously described. The end result of the work at this point is the very small round fluorescent spot, and patience in eliminating the last small amount of magnetic interference will pay off in clean, sharp patterns and pictures later on. One further caution—the fluorescent screens of cathode-ray tubes "burn" quite easily if the spot is made too bright. Therefore, during the process of eliminating magnetic interference, caution should be used in keeping the intensity of the spot as dim as possible at all times. This same test should be repeated when the scope is completed, since the additional load of the various tubes may aggravate any magnetic trouble.

Once this point has been passed, the construction proceeds easily and rapidly. Both output deflection amplifier tubes, V_4 and V_9, should be wired next. It will be noted in the photograph of Fig. 7 that the amplifier output coupling condensers, C_{22} and C_{23}, have been mounted with their metal cases *insulated* from the chassis to minimize the stray capacity to ground. These condensers are mounted by one of their connection terminals on a ceramic feedthrough insulator, thus making a convenient means of connecting to the cathode-ray tube on top of the chassis. It should be further noted that the plate load resistors and peaking chokes for both the input and output stages of each amplifier have been mounted on bakelite terminal boards which, in turn, are mounted a substantial distance away from the chassis. This mounting system affords convenient terminals for the components themselves, and what is more important, minimizes the capacities between these components and ground. Connections between the plates of V_4 and V_9 and the coupling condensers, C_{22} and C_{23}, are made with heavy copper wire, as can be seen in Fig. 7, and go via the terminal strip on the rear of the chassis, thus permitting direct connection to the two deflection plates if desired.

Once the wiring of V_4 and V_9 has been completed, these stages may be readily tested by connecting a potentiometer between ground and the hot side of the 6.3 volt a.c. filament winding, then connecting the arm to the grid of V_4 or V_9 through the input coupling condensers, C_{17} or C_{40}. If the amplifier is functioning properly, a line will appear on the tube screen as the voltage from the potentiometer is increased. This line should expand an equal amount in both directions as the voltage is increased and should continue to do so until both ends are deflected off of the screen.

The horizontal amplifier cathode follower and triode amplifier tube, V_2 and V_3, and its vertical counterpart, V_7, and V_8, may be wired and tested next. The preliminary test procedure for either complete amplifier chain is the same as for the output deflection amplifier previously described, except that in this case, the 6.3 volts a.c. may be direct-connected to the grid of the cathode follower, and the gain controls, R_{13} and R_{48}, (See Fig. 4) used to vary the amplitude.

Following the completion of the amplifiers, the "Horizontal" and "Vertical Input Selector" switches, S_1 and S_3, should be wired next. The various components associated with these switches should be mounted directly on the switches themselves insofar as is possible. These switches may be seen in Fig. 7. As the full 775 volts is applied to the sweep oscillator through these selector switches, it is desirable to mount them with their shafts insulated from the panel to assist in preventing any voltage breakdown between the high voltage contacts and ground. The attenuator trimmers, C_2 and C_{31}, are mounted on these switches in a position convenient for adjustment. Setting of the attenuator trimmers is discussed under "Testing and Adjustments."

The final stages to construct in this instrument are the Horizontal and Vertical Scanning Oscillators, V_1 and V_6.

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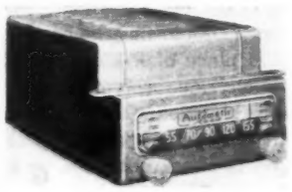

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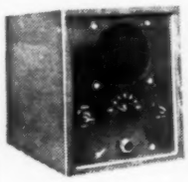

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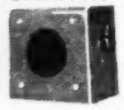

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In completing this wiring several precautions may prove helpful. It is wise to insulate the frequency adjustment controls, R_9 and R_{41}, from the panel as the full 750 volts are applied to these potentiometers. In the horizontal oscillator circuit the condenser, C_8, should be soldered directly between plate and cathode with short leads. It is also desirable to mount the output coupling condenser, C_6, at least ¼" from the chassis to keep its capacity to ground low. If metal cased condensers are used for this or any of the other coupling condensers between the amplifier stages, their metal cans *must* be insulated from the chassis to keep these capacities to ground small.

Testing and Adjustments

The adjustments necessary to complete this Television Oscilloscope are not unduly difficult. The frequency range of the two scanning oscillators must be properly set by adjusting the resistors, R_7 and R_{44}; the high frequency response of the deflection amplifiers should be checked; the two input attenuator trimmers, C_2 and C_{31}, must be properly adjusted; the horizontal scanning oscillator attenuator trimmer, C_3, must be set.

To adjust the vertical scanning oscillator frequency, the hot side of the 6.3 volt heater winding should be connected to the "H. Amp. In." jack and the "Horiz. Input Selector" set to the "Low" gain position. The "Vert. Input Selector" is then set in the "Scan" position and the "Vertical Scan Frequency" control set at the position of *minimum* resistance, which should be fully clockwise. A potentiometer having about 10,000 ohms resistance should now be connected temporarily in place of R_{44} and adjusted until one cycle a.c. waveform stands approximately stationary on the screen. The resistance required to bring about this condition is then measured with an ohmmeter, and a fixed resistance of this value is then permanently soldered in the circuit.

In adjusting R_7 to the proper value, the same general procedure is followed. However, it is preferable to use a frequency of 1400 cycles, which coincides to the lowest frequency limit of the second highest frequency range of S_4. This requires an accurate audio oscillator, but if one is not available, fairly satisfactory results may be had in setting R_7 by utilizing the 60 cycle point of the lowest frequency range in conjunction with the 60 cycle a.c. filament voltage.

In either case, the a.c. frequency comparison voltage is connected to the "V. Amp. In." jack, the "Vert. Input Selector" is set at "Low" and the "Horiz. Input Selector" is set at "Scan". Care should be taken to see that the "Horiz. Sync" switch is in the "Ext." position.

It should be remembered that the lowest frequency on any range is secured when all the resistance of R_9 is in the circuit, and the highest when none of it is in. Once all controls have been properly set, R_7 is rotated until *one* sine wave cycle of oscillation appears approximately stationary on the screen.

While not absolutely necessary, it is desirable, if an audio oscillator is available, to check the frequency coverage of all six ranges of the "Horizontal Scan Frequency" selector switch, S_4, to make sure that the frequency ranges coincide approximately to those shown on the panel in Fig. 3, thus making certain that there is continuous frequency coverage between 20 and 20,000 cycles.

The commercial tolerances of components together with their placement within the oscilloscope may make the *actual* frequency response of a deflection amplifier a little different than its *expected* frequency response. This deviation, if any, will be most noticeable at the high frequency limit. Therefore, if peak performance is expected from the instrument, it is highly desirable to actually check the high-frequency response. Fortunately, this may be accomplished very easily with the aid of a square-wave generator operating at approximately 15 kc. This frequency was chosen since an amplifier's high frequency response must be substantially flat up to approximately the 15th harmonic of the square-wave fundamental frequency in order to actually pass the square-wave without noticeable distortion.

Since a square-wave generator is seldom found in the experimenter's laboratory, a simple circuit for such a device is shown in Fig. 5. As can be readily seen, it consists of a 6SJ7 transitron sine wave oscillator driving a 6SN7 wave-squaring amplifier. No adjustments have been included, since only one frequency and one output voltage are needed. The circuit is nearly foolproof in operation. Upon completion, it is desirable to check the actual output wave shape to secure a basis for comparison when checking the amplifiers. This is accomplished by running the output of the square-wave generator through two, short, unshielded leads directly to the vertical deflection plate connection on the rear of the oscilloscope and to the "H. Sync. In" jack on the panel. An additional ground lead should connect the two chassis. With the "Horiz. Sync." switch in the "Ext". position, the "H. Sync. Gain" and "Horizontal Scan Frequency" controls are adjusted until two or three stationary square waves are observed on the cathode-ray tube screen. This pattern should be carefully noted, as it is the "standard" by which the amplifier's performance is judged.

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Life time aluminum case with bakelite handle, lock and key. Size 15" long, 11" wide, 5" deep. Weight only 3 lbs. Shipping weight approx. 5 lbs.
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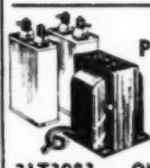
3 WAY "PERSONAL" AC.- DC, and BATTERY OPERATED PORTABLE

Superhet circuit, 4 tubes plus Selenium rectifier. 5" Alnico PM speaker. Iron core I.F. Safety switch for operation from 110 volt AC or DC electric current or from self contained batteries (1-746 "A" and 1-467 "B") available anywhere. Beautiful dual colored Polystyrene Shatter-proof molded cabinet with plastic easy grip handle. Large slide rule dial. Vernier Hi-ratio tuning. Small: only 4" wide, 8⅝" long, 7¼" high. Weight only 5¼ lbs. with batteries. **A "Honey" for in the home or "on the go."**
No. 36A66 Less Batteries, ONLY..... $21.95
Set of batteries (1-746 and 1-467)..... $2.40

1000 V. — 200 Ma. Power Supply FILTER KIT



Consist of Two 4 mfd. 1000 volt DC oil filled condensers size 2½x 1⅛x5½" high overall and One Thordarson 10 Hy.-200 Ma. filter choke fully enclosed metal case size 3⅜" sq x 4⅝" H.
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Well known brand. **Ceramic pillar terminals, in hermetically sealed metal case,** size overall 1¾x3¾x5½" high. Comes with handy removable mtg. bracket and solder lug terminals.
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In FT 243 holders, cut from highest quality quartz, accurately ground and acid etched. Frequency marked on each with-in 2 KC. Sorry we must sell them in assts. our pick of frequencies—**but you can't go wrong! There are plenty of choice frequencies for 80, 75 and 40 meters** or for doubling to 20 and 10 meters in each asst. **Every one guaranteed to be an active oscillator.**
Stock No. 21T 3991 Assortment of TEN — ONLY..... $3.95

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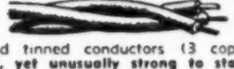

Stranded tinned conductors (3 copper, 4 steel) **flexible, yet unusually strong to stand long runs.** Conductor is rubber covered with **overall weather-proof saturated braid;** OD 5/32".

Perfect for lead-ins, telephone, intercoms, etc. BRAND NEW in original factory wound coils.
No. 4A503, Three Conductor Per 550 Foot Coil, ONLY..... $4.95
No. 4A502, As above except Single Cond. Per 900 Foot Coil, ONLY..... $2.95

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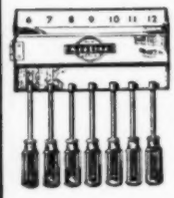
XCELITE NUT DRIVERS
DE LUX SET NO. 27



Colored handles for easy identification. Comes in handy, lockable metal tool holder. Fire- and shock-resistant plastic handles. Precision formed sockets deep enough to handle two nuts.

Set of 7 Drivers and Handy Holder **3.90** Net

XCELITE SET NO. 17
Set of 7 nut drivers similar to above with handles all same color. In metal stand. **3.36** Net

***SPECIAL!* PYREX ENTERING INSULATORS**

- NUMBER—67076
- BOWL—67037
- GLASS — OPAQUE
- LENGTH, CENTER PIN — 11½"
- OUTSIDE BASE DIAMETER — 8¾"

Furnished with a template ring 1/16" thick for locating mounting holes for the 2-9/16" studs. Template can also be used as backing ring or washer. Equipped with two 3/8" jamb nuts for lower end of center pin and two 1/2" jamb nuts for each stud. Same as illustration, but opaque.

A Resco Special!

REGULAR PRICE $29 **$5**

2-VOLT SINGLE CELL STORAGE BATTERY

As used in models of General Electric Portable receivers. 3" wide, 4" deep, 5½" high. In clear plastic case, with 3 colored balls to show state of charge. Complete with charging and maintenance instructions. Shipped dry.

Qt. Bot. of Acid **95¢** **1.49** Net

Special! 4-Prong 6-Volt
VIBRATOR

Similar to Mallory 294 or Radiant 5300.

95¢ *Each* **90¢** *Ea. Lots of 12* **85¢** *Ea. Lots of 25*

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To check the vertical amplifier's high frequency response, the output of the square-wave generator is fed to the "V. Amp. In." jack and the "Vert. Input Selector" is set in the "High" gain position. With the "Horiz. Sync." switch now in the "Int." position, the various frequency and gain controls are adjusted until several stationary square-waves appear.

If the amplifier is performing properly, these square waves should have exactly the same waveshape as when the generator was connected directly to the vertical deflection plate. The important points to notice are the sharpness of the corners and the flatness of the tops. If any of the corners are rounded, or the tops not perfectly straight, the value of cathode condenser, C_{39}, should be altered to achieve the squarest possible waveshape.

By simply rotating the "Vert. Input Selector" switch to the "Low" gain position and advancing the "Vertical Gain" control somewhat, the input attenuator condenser, C_{31}, may now be set. This adjustment should be made with an insulated screwdriver and will be correct when the same, undistorted square wave is obtained.

In testing the horizontal amplifier, altering the value of C_{18}, and setting the attenuator trimmer, C_2, the same procedure is followed except that the horizontal and vertical control functions and connections are interchanged. One additional lead must be run from the output of the square-wave generator to the "V. Sync. In." jack, and the vertical sweep frequency condenser, C_{36}, must be temporarily changed to .001 μfd. to secure a sufficiently high sweep speed. In this case the square waves will appear vertically instead of horizontally.

The final adjustment on the Television Oscilloscope is the setting of C_3, part of the output attenuator for the Horizontal Scanning Oscillator. To do this most easily, a source of 150 kc. oscillations should be available. If not handy, such as oscillator may be easily made by changing the values of the tuned circuit for the 6SJ7 transitron oscillator in Fig. 5 to 2.5 millihenrys for the inductance and .0005 μfd. for the condenser. With the 150 kc. output (taken directly from the 6SJ7's suppressor grid, pin No. 3), connected to the "V. Amp. In." jack, the "Horiz. Sync." switch is placed in the "Int." position, the "Horizontal Scan Frequency" selector switch is placed in the highest frequency position, and the instrument is then adjusted until 10 cycles of oscillation, including those which can be seen on the return trace, are stationary on the screen.

It will be found that the setting of C_3 influences both the linearity of the scanning trace (the equidistant spacing of the a.c. cycles) and the return trace time (the dimmer of the two traces). The proper setting of this condenser will be the point where the fewest number of cycles appears on the *return* trace, while maintaining good linearity on the *scanning* trace. If the circuit is functioning correctly, it should be possible to get less than one and one-half cycles appearing on the return trace while keeping good linearity. This indicates that less than 15% of the time for each scanning cycle is occupied by the return trace.

Test Leads

The simplest method of connecting voltages to be observed on the cathode-ray tube screen to the instrument is through a short length of unshielded wire, with an additional short wire run between the ground connection of the oscilloscope and the chassis under observation. Such a connection, however, requires that the oscilloscope and the item under test be close together, and in addition, if the voltage being observed is small the stray pickup of the unshielded lead may seriously distort the pattern. Although a shielded lead does overcome stray pickup, it is generally unsatisfactory, as any usable length may have sufficient capacity to upset both the circuit under test and the high frequency response characteristics of the oscilloscope.

To overcome these difficulties, it is most desirable to construct one or more of the attenuator-type test leads similar to those furnished with some commercial oscilloscopes. This type of test lead may be made any reasonable length from shielded cable without any frequency discrimination taking place, and in addition, it affords a very light load to the circuit under test. The circuit for this test lead is shown in Fig. 6A and a sketch of one possible layout for the test prod and cable is shown in Fig. 6B. This will be recognized as the familiar resistance-capacity attenuator used several times previously in this instrument, but in this case, one of the condensers making up the attenuator is the actual capacity of the shielded cable itself. No value is given for the resistance connected across this cable capacity, since the value will depend on the type and length of cable used. It will probably fall, however, in the vicinity of 150,000 ohms. The small trimmer in the test prod is adjusted just like the similar trimmer was adjusted for the "Low" position attenuators in the oscilloscope itself with the aid of the 15 kc. square-wave generator output applied to the input of the prod itself. The resistor across the cable capacity should be cut and tried until the familiar square wave can be obtained. Once properly set, the prod capacity adjustment should be covered as it will not require changing unless the cable itself is changed.

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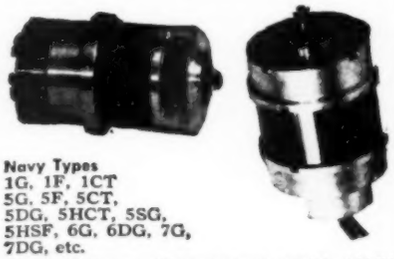
SYNCHROS



Navy Types
1G, 1F, 1CT
5G, 5F, 5CT,
5DG, 5HCT, 5SG,
5HSF, 6G, 6DG, 7G,
7DG, etc.

Pioneer Autosyns—AY-1, AY-14, AY-20, AY-30, AY-54, AY-101D, 851, etc.

Elinco M1-1, M1-2. **Kollsman** 775-01. **G.E.** 2J5HA1, 2J5FB1, 2J6F3, 2JD5HB1, etc.

DC MOTORS

John Oster. Series wound. 27 V. 7000 rpm. 1/100 H.P. Stock #SD-30. **Price $2.75 ea.**

Westinghouse—1171391. 27 V. 6.5 amps. series. Fan cooled. 3" diam. 4½" lg., ⅛ H.P. Cont. duty stock #SD-156. **Price $6.75 ea.**

Delco 5069370. 27.5 V. Alnico field. 10,000 rpm. Similar to S-65 but has straight shaft extension. Stock #SD-16. **Price $4.75 ea.**

DC Timing Motor—Haydon ⅓ rpm. 29 volts, 100 mills. Stock # SD-157. **Price $3.75 ea.**

Constant Speed D.C. Motor—G.E. 5BA25MJ24. 24 V. D.C. 7100 rpm. RC noise filter. Stock #SD-100. **Price $8.50 ea.**

Radio Compass Loop LP-21-LM. Stock #SD-99. **Price $9.50 ea. net.**

Phase Shift Capacitor — 4 stator single rotor. 0-360° phase shift. Stock #SD-114. **Price $4.75 ea.**

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Null Type Synchro Indicator

Consists of Bendix size 5 synchro, rectifier, transformer, magic eye tube and illuminated 360° dial. Manually tuned to null. Ideal for experimenters and labs. Stock #SD-119. Shipping wt. 10 lbs. **Price $6.95 ea.**

Size 5 Synchro Generator

Similar to Navy Ordnance type 5G with shaft detail per Army Ordnance Dwg. C-78414. 115 V. 60 cy. Stock #SD-43. **Price $9.50 ea.**

SERVO MOTORS

Pioneer CK-2, CK-5, 10047-2-A and **Kollsman** 776-01 for 400 cycles.
Diehl FP-25-3, **FPE-25-11** (CDA-211052) and **ZP-106-8** (CDA-211377) for 60 cycles.
Quantity Prices on Request.

400 CYCLE MOTORS

E.A.D. J-33. 115 V. 3 phase. Synchronous. 8000 rpm. 2" x 3". Stock #SD-59. **Price $6.75 ea.**

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Alnico field. 27.5 V. 10,000 rpm. 1" x 1" x 2". Use as motor or as tachometer generator. Stock #SD-65.

Price $1.95 each
Add 15c for P.P. & handling

Microwave Antenna—
AS-217A/APG 15B. 12 Cm dipole and 13 inch parabola housed in weatherproof Radome 16" diam. 24 V. DC spinner motor for conic scan. Stock #SD-95. Shipping wt. 70 lbs. **Price $9.50 ea.**

Remote Position Indicating System—

6-12 V. 60 cycles. 5 inch indicator with 0 to 360° dial. Heavy duty transmitter. Stock #SD-115. **Price $9.95 per system**

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Pioneer
12116, 12117,
12121, 12123, etc.
Holtzer Cabot MG-149F, MG-149H, MG-153F, etc.
General Electric 5D21NJ3A, etc.
Leland 10563, etc.

60 CYCLE AC MOTORS

G. E. Reversible. 1/150 H.P. Shunt wound. 40 volts 5000 rpm. Split field. Stock #SD-18. **Price $4.75 ea.**

Stock #SD-19. Similar to above but not split field. **Price $2.75 ea.**

Barber-Colman. 0.001 H.P. wound shaded pole type. Reversible by relay or s.p.d.t. switch. Stock #SD-27. **Price $3.75 ea.**

Timing Motor — Haydon 1 rpm. 115 V. A.C. Stock #SD-133. **Price $2.85 ea.**

G. E. Amplidyne—5AM45DB15. MG-16-A. Input 115 V. 60 cy. Output 250 V. D.C. at 0.6 amps. Cont. Duty. Stock #SD-147. **Price $59.50 ea.**

DC Selsyn System—24 V. D.C. transmitter and indicator. Indicator calibrated for flap position. 360° dial easily added. Stock #SD-129. **Price $9.50 per system.**

Pioneer Magnetic Amplifier Assembly. Saturable core type output transformer. 400 cycle. Operates from plates of 6SN7 to supply 1 phase of servo motor. Stock #SD-44. **Price $8.75 ea.**

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Elinco PM-2
1.75 V. D.C. 100 rpm. Use to 2000 rpm. Stock #SD-53. **Price $6.25 ea.**

Elinco FB-55. 4.7 V. per 100 rpm. Use to 10,000 rpm. Stock #SD-3. **Price $12.50 ea.**

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Less output transformer **$1.19**

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A favorite, high quality, dependable headset. Highly sensitive, practical phones for every headset use. Has adjustable, flexible metal-split headband; 4½ Ft. covered cotton cord **$1.79**

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600 VOLT

STANDARD BRAND

mfd	price ea.	price per 100
.01	.07	$ 6.00
.02	.07	6.00
.1	.13	12.00
.05	.11	10.00
.001	.07	6.00
.002	.07	6.00
.005	.07	6.00
.25	.16	15.00

TUBE SPECIALS!

BRAND NEW STANDARD BRAND

	list	Our Special!
1LN5	$2.65	96c
0Z4	2.20	88c
35Z5GT	1.15	46c
50L6GT	1.50	60c
12SA7GT	1.80	72c
12SK7GT	1.50	60c
12SQ7GT	1.50	60c
35W4	1.15	45c
6J6	2.65	79c
50B5	2.80	70c
6SN7GT	2.20	88c
117L7GT	3.90	1.56
12A8GT	1.80	72c
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8x16 Mfd., 450 V. Tub. Electrolytic Condenser.... 69c
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100 mfd 25 volts Tub. Cond. 29c

Tubular Type Television Condensers

.002 2500 Working Volts
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SPECIAL 63c each

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Antenna Loops—Medium Size	$ .24
Selenium Rectifiers—100 mill	.74
8" 4 ohm auto speaker	3.19
12 inch PM Speaker, Alnico 5 Magnet handle up to 10 Watts	4.79
No. 22 Solid Pushback wire, 100 Ft. rolls; Var. Color	.49
No. 40, No. 42, No. 44, No. 46, No. 47 PILOT LAMPS. Box of 10	.44

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The uses to which this instrument may be put are almost limitless and no attempt will be made here to list all the possibilities. However, a few generalities concerning its use may assist those not having had previous experience with such a device.

This instrument will serve two basic purposes, namely, permit observation of various voltage waveforms, and function as the picture and scanning portions of a complete television receiver. When viewing waveforms, the generally followed procedure is to apply the voltage under test to the "V. Amp. In." jack. The "Horiz. Sync." switch is usually used in the "Int." position and the various sync and amplifier gain and frequency controls are then adjusted until the desired number of cycles of the waveform under observation appear stationary on the screen.

The following generalities should always be observed for most satisfactory use of the oscilloscope. (1) Always view the various waveforms as large as possible consistent with the information desired. (2) Always turn the intensity of the pattern to the lowest point which still gives an image of comfortable intensity. (3) Always use the lowest value of sync. voltage which will permit the pattern to stand still as too much sync. will lengthen the return trace time in some cases and cause pattern distortion in others. (4) Always keep the spot moving either with the sweep oscillator or some other voltage so that the cathode-ray tube beam will not burn the screen.

Using this instrument to observe television pictures is relatively simple. Horizontal and vertical sync. signals having positive polarity are required to synchronize the two scanning oscillators, and a negative video voltage is required to operate the grid of the cathode-ray tube. Both "Input Selector" switches are turned to the "Scan" position. The frequency of the horizontal oscillator is then set to approximately 15,000 cycles per second (in the case of standard 525 line television pictures) and the vertical oscillator is set at approximately 60 cycles. The "Horiz. Sync." switch is set in the "Ext." position, and the two synchronizing voltages are connected to the "H. Sync. In." and "V. Sync. In." jacks respectively. The video voltage is connected through the shortest possible lead to the "Grid" terminal. The two "Sync. Gain" controls are then simultaneously adjusted with the two "Scan Frequency" controls until the television picture is synchronized both horizontally and vertically, then the "Horizontal Gain" and "Vertical Gain" controls are adjusted to give the desired picture size. The reader may be interested to know that the instrument described herein was used for some months to watch the experimental transmissions from the *DuMont* television station in Washington, D.C., with considerable success.

This instrument cannot rightly be called "simple", yet it is completely straightforward in most respects. In completing the construction and adjustment of this oscilloscope the work should not be rushed, as it will be found that the satisfaction of building and using an instrument of such versatility and performance will make the effort expended well worthwhile. A modest amount of skill and a considerable amount of care will pay off handsomely in this project.

—30—

1948 PARTS SHOW HELD MAY 11-14

THE 1948 Radio Parts and Electronic Equipment Conference and Show being held at the Hotel Stevens in Chicago from May 11-14th promises to be the biggest the industry has ever sponsored.

Arrangements have been made with American Television, Inc. to televise the Show. From vantage points in several parts of the Exhibition Hall, latest model orthicon cameras and links will scan the 168 booths and also telecast interviews with Show officials, exhibitors, and prominent visitors.

This year's "Keynote Dinner" will feature a novel program which will include some of show business' brightest stars. No formal speeches have been scheduled for the banquet as the emphasis is being placed on theatrical entertainment.

According to this year's program, Sunday, May 9th and prior days will be devoted to sales meetings with the erection of displays in the Exhibition Hall on Sunday. Monday will be "Associations' Meeting Day" with meetings scheduled for NEDA; "The Representatives" of Radio Parts Manufacturers, Inc.; "Canadian Luncheon", Radio Parts Sales Manager Assn. of Canada; Sales Managers Club, Eastern Division, and the Association of Electronics Parts and Equipment Manufacturers in joint session; Radio Parts and Electronic Equipment Shows, Inc.; and the Industry Dinner.

Tuesday will be "NEDA Day" with attendance at the Exhibition Hall confined to exhibitors, their booth attendants and sales representatives, and to members of NEDA. Wednesday will be "Invitation Day (Courtesy NEDA)" and Thursday will be "All Distributor Day" —both days being open to all distributors. Friday will be "All Industry Day" with attendance open to all persons connected with the radio parts and electronic equipment industry. —30—

International Short-Wave

(Continued from page 144)

11.913 and 7.153, 0845-1100; news 0900, and Ministry of Foreign Affairs news 0915; on Sundays at 0930-1000 has "Bringing Christ to the Nations." To Europe, America, China, South Seas, 11.913 and 7.153, 1100-1145; news 1100; off 1145 with Chinese National Anthem.

Kary, Pa., has received these late schedules of XGOA, Nanking — (1) to North America, 1930-2300, news 2110, 2330, commentary 2140, talks 2200, Chinese opera (*English* introduction) 2240, 11.835, 9.730; (2) musical hour (Mon., Peiping Opera; Tue., symphony; Wed., Cantonese Opera; Thurs., Chinese Concert; Fri., symphony; Sat., Peiping Opera; Sun., Sunday Music), 0300-0400, 11.835, 9.730, 660 kcs.; (3) to Philippines, Australia, New Zealand, South Pacific Islands, 0400-0600, 11.835; news 0500, commentary 0530, talks 0440; (4) to Mongolia, Tibet, South Sea (Chinese), 0600-0700, 11.835, *no English;* (5) to Japan, Siberia, 0700-0830, 11.835, *no English;* (6) to India, South Africa, Eastern Europe, 0830-1015, 11.835, news 0900, Fr. news 0840. (*It is quite likely that XGOA will replace* 11.835 *with* 15.350 *for the summer months.* The 11.835 outlet has been heard with improved signals since the Manila relay of "Voice of America" moved to 11.89 from 11.84.—K.R.B.)

Sanderson, Australia, reports XPSA, 7.010, Kweiyang, is heard with Western music at 0630 and with short *English* news at 0700; reports XMAG, 4.27, Nanking, with AFRS program at 0600, good level, and XMNG, 7.34 (location not indicated) at 0615 with news in Chinese, some QRM.

Curacao—PJC2, 7.250, "Radio Princess Juliana," Willemstad, has *English* program on Wednesdays at 2000 - 2030; power is given as 3 kw. (Boice via Southall, Pa.)

Czechoslovakia—Prague appears to be using 11.840 to North America daily, 2000-2100, with news around 2000 or 2035; signal has been improving lately. (Bishop, Ohio)

Dominican Republic—H12T, "La Voz del Yuna," located at Ciudad Trujillo, has been reported using various frequencies in the 31-meter band, but more recently seems to have settled on about 9.735, signing on around 0700 with powerful signal.

Egypt—SUX, 7.867, Cairo, is heard in Ireland around 1445-1630. (MacAnaspe)

Ethiopia—ETA, Addis Ababa, 15.057 (varies) has not been heard in Newfoundland recently. (Peddle) Brownless, England, reports that one on about 15.075 on Saturdays at 1230. Also heard Saturday at 1320 (some weeks ago) in Philadelphia. (Southall, Pa.)

ESPEY Television Training Kit

Learn television through this unique "assembly line" procedure. Modern circuits and postwar design make up-to-the-minute training an absolute necessity. This ESPEY television training kit will help you understand and gain a working knowledge of TELEVISION—the latest development in electronics. FREE with every kit—a new type of pictorial instruction book, giving easy-to-follow, step by step method. No previous knowledge of television necessary to build—and LEARN from—this ESPEY kit.

FEATURES

- *18 tubes, including 15 miniatures.*
- *3 stage, stagger tuned pix i.f.*
- *21.25 Mc sound i.f. Trap tuned.*
- *Balanced FM discriminator.*
- *Portable—weighs only 17 lbs.*
- *Uses 3" low-cost cathode ray tube. Magnifier makes 20 sq. in. picture.*
- *Can be aligned with ordinary test oscillator and V.T. Voltmeter.*

KIT INCLUDES: All i.f., power blocking oscillator transformers, chokes, capacitors, resistors, controls, speaker, and sockets riveted into place on punched and welded chassis. All tubes are easily-obtainable types available through distributors everywhere.

*Prices 5% higher West of Rockies.

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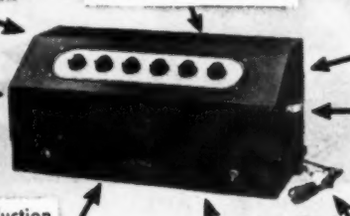

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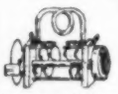

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Finland—OIX2, 9.500, and OIX4, 15.19, have improved signals in 0715 news, latter still has QRM from Delhi. (Peddle, Newfoundland)

Formosa—XURA, 7.222, Taiwan, recently has *not* been carrying the XGOY (Chungking) news relay 0900. (Dilg, California)

France—"Ici Paris," 6.200, is heard in England with powerful signals around 0700, may be 100 kw. (Pearce)

French Equatorial Africa—Radio Brazzaville, 9.44, 11.972, has a short *Mailbag* session after the 1900 news period on Mondays. (Boice via Southall, Pa.) The 9.984, 17.84, and 6.024 outlets have not been heard lately. (Peddle, Newfoundland)

French Indo-China — Major, Western Australia, reports *Radio France,* 6.048, Hanoi, still using this frequency with news 0700, with musical theme of "Beer Barrel Polka." The Broadcaster, Western Australia, lists *Radio France,* 6.048, Hanoi, as operating 1900-2030, 2330-0115, and 0500-0930; *Radio Cambodge,* 6.035, Pnom-Penh, at 1900-2015, 0000-0115, 0600-0800.

French Morocco—CNR3, 16.666, Rabat, is heard in East around 0700-0845 sign-off. (Kary, Pa.)

Germany—Frankfurt, 6.190, is heard in England at 1715; *no English: Radio Stuttgart,* 6.180, is heard closing down at at 1730 in German and *English,* sometimes giving weekly program schedule resume. (Pearce, England)

Baden-Baden, 6.320, is heard fairly well in New Zealand around 0200. (Clark)

AFN, 6.080, Frankfurt, is scheduled 0000-1800; sends nice QSL card. (Miers, Berlin)

Relays from the United States are carried by Munich III, 6.170, 1300-1400; Munich IV, 7.250, 1115-1215, 1415-1700; Munich II, 9.540, 1115-1700; Munich I, 11.870, 1115-1700, and Munich IV, 15.150, 1230-1400; all are beamed on East Europe.

Greece—"Edo Ethnikos Stathmos Tis Eleftheria Elathos" ("This is the National Station of Liberated Greece"), in Gen. Markos' territory, Communist, now runs 0100-0130 on 7.646. (Bouras, Michigan, via URDXC)

SVM, 9.935, often contacts New York at 1415, and around 1700-1930. (Beck, N.Y.)

Greenland—OZI, 5.942, Godthaab, is heard in Newfoundland with weak signal, bad CWQRM, at 1700-1745. (Peddle) Is heard in Sweden QSA-2-3, at 1645-1745. (Bergstrom)

Guatemala—TGWA, 9.76, and TGWB, 6.435, run to 0005 (in dual).

Haiti—According to a "temporary" verie received by Kary, Pa., from HHYM, operating at present on a "reduced" 6.000, Port-au-Prince, the transmitter is power of 500 watts; very soon they will be permanently installed and will have

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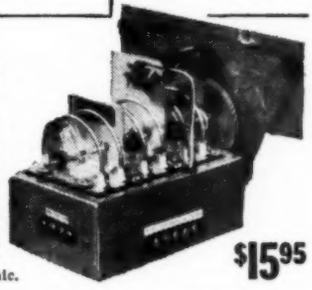

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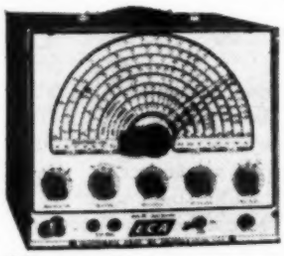

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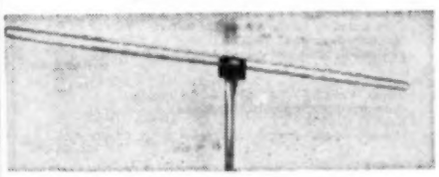

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2000 volt D.C. Power Supply

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Hawaii—KRHO, Honolulu, relaying U. S. programs, is scheduled on 15.250, 0400-1005, and on 17.800 (UN programs), 0230-0345, beamed to Philippines and China.

Iceland—Although TFJ, 12.235, Reykjavik, is scheduled Sundays (*only*) at 1115-1145 with news in Icelandic and music for Icelanders abroad, it has not been reported to me as having been heard in America.

Italy—Radio Italiana appears to be using 9.63 and 11.81 for the North American beam around 1915-2010, news 1950. (Dunham, North Carolina) An *English* period is also scheduled 1445-1500 on 9.63, 6.085. (Pearce, England)

Java—Major, Western Australia, lists YDH2, 11.030, Semarang, good at 0600, heard signing off 0630, but heard later back on the air; "have seen this listed as Borneo, but Semarang is in Java."

Radio Batavia's daily 0930-1000 transmission to the U. S. and Canada is now radiated on a new (announced) frequency of 8.916, replacing 11.440, but appears to be much lower, around 8.900 to 8.910. (Stark,Texas, and Dilg, California) The 15.145 outlet, used in parallel to Australia, Malaya, is heard well here in West Virginia but I have not yet found the new (8.916) channel audible. Call-sign of the new outlet is PLA8. (Stark, Texas)

Dilg, California, reports improvement in signals from Java—Bandoeng, 10.062 Sunday (which is not regular schedule); and 7.997, recently were heard on a some days 10.062 appears to be used all morning for phone traffic; Batavia's 10.365 at times is good to 1030 sign-off; 25.-m. outlets have been weak usually on West Coast.

Dorothy Sanderson, Australia, lists Sourabaya on 8.12, heard at 0630 with musical program and announcements in Dutch.

"The Voice of Indonesia," 11.000, is heard in Texas with new 0630. (Stark)

Korea—The Seoul outlets of HLKA, 2.510 and 7.933 (used in parallel), although scheduled to sign-off around 0835, recently have been heard in California as late as 0905. (Dilg) In verifying for Kary, Pa., Howell S. Teeple, Advisor, Radio Bureau, Dept. of Public Information, Seoul, said transmitter is a 5-kw. Japanese Electric; antenna is a half-wave doublet; schedules are listed 2100-0000, 0330-0830, 1630-1830; Kary's was first report received from the U. S.; it was stated that this station is a key network station for a series of 10 stations located throughout south Korea, necessary for relaying programs due to a lack of telephone lines in that country. Station is operated by Koreans under the supervision of Americans; frequency on verie was listed 7.935, but has been measured in East as 7.933.

Lebanon—News of Syria (in *English*) is read by a woman at 1100 from *Radio Beirut,* approximately 8.017 (listed 8.020V). (Radio Week, South Africa) Is heard in Newfoundland 0000-0100, 1345-1600. (Peddle) Some days runs to 1630.

Luxembourg—Radio Luxembourg's 15.35 channel, formerly heard in East around 0700-0830, has not been reported as heard lately.

The 6.090 outlet is heard in Newfoundland at 1415-1445. (Peddle)

Madagascar — Radio Tananarive, 10.615 and 6.065, is heard in Newfoundland at 1330-1400 sign-off (closes with "La Marseillaise"); has symphonic music at 1330-1345, followed by world news in French; the 9.695 channel (scheduled in parallel) is not audible. (Peddle)

Malaya—Major, Western Australia, says *"Radio Malaya,"* 4.825, Singapore, is good level at 0930, signs off 1030.

According to a letter received by Kary, Pa., from the British Far Eastern Broadcasting Service, Singapore, hours of broadcasting have been greatly curtailed for the present and most programs are now relayed from the BBC's Far Eastern, Eastern, or General Overseas Service; schedule was given as 6.77, 0400-1135; 9.69, 0530-1135; 11.73, 0400-1135; 15.30, 0400-1135; 21.720, 0400-0530; all were listed 7½ kw. except 21.72 which uses only 5½ kw.; news headlines 0400, news 0450, news 0645 (news, talk, *English lesson*), news 0915, news 1100. Both Purple and Orange Networks have been discontinued, and about 60 per-cent of the personnel has been dismissed, the letter stated.

The 9.690 outlet is heard in California signing off *daily* 1130. (Dilg) Is audible but weak here in East to around 1030 or later. The 21.720 outlet has been heard in England from 0400 sign-on, news 0403 and 0450, then Eastern session from 0500-0530 sign-off. (Pearce)

Mexico—XEEP, 6.155, "Radio Educacion," Mexico City, is heard in New York evenings with fair signal, much classical music. (Legge)

Monaco—Prendergast, New York, reports *Radio Monte Carlo,* listed 6.132, has been heard at 1645-1715 sign-off, announcing return at 0100; uses French.

Mozambique—CR7BJ, 9.645, Lourenco Marques, is heard in Newfoundland as late as 1525; "always has excellent signal." (Peddle)

Norway—Norsk Rikskringkasting (Norwegian State Broadcasting), Oslo, informs Stanley Worris, Florida, that due to rationing of electricity (caused by an exceptionally dry summer last year), they have not had an opportunity to expand transmission times as they would have liked. They add, "Our transmitter is located in southern Norway at Fredrikstad at the east side of the Oslo Fiord, and the antenna is directed East-West from that city. This particular short-wave service for Norwegians

abroad takes place each night between 0100-0200 GMT (2000-2100 EST). That is the only time of the day when our 100 kw. transmitter operates on 9.610, and 11.850 and 6.185 (8 kw. each) are in parallel for the 2000-2100 EST transmission; the latter two are beamed South and West and North and West, respectively.) The letter mentioned a broadcast in Norwegian at 0130-0230 on 11.735.

Is heard on 11.735 and 9.610 occasionally in New York around 0200. (Beck) The 9.610 channel is heard irregularly on West Coast around 0145-0230 (off Sundays), news in Norwegian 0200. (Balbi, California)

The 6.185 outlet has been heard in England signing off around 1724, after news in Norwegian. (Pearce)

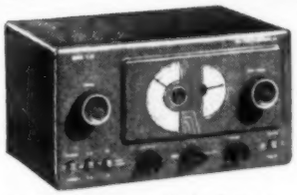
Pakistan—According to Radio Times of India, headquarters of the Pakistan Broadcasting Service are reported to have decided to move to Karachi from Lahore. Future plans include a 100-kw. short-wave station and a 5-kw. medium-wave station for Karachi; a 20-kw. short-wave station for Dacca; and a 5-kw. medium-wave station for Hyderabad. Karachi should be on the air on s.w. by this time. (*Your ISW Editor would appreciate details on operations of Pakistan Radio as they are available.*—K.R.B.)

Palestine—According to overseas publications, JCKW, Jerusalem, has left the air. (Southall, Pa.) Not reported as heard lately.

Paul Kary, Pa., recently received a letter from the Chief Engineer, Near East Arab Broadcasting Station (Jaffa) stating that "the old British Mediterranean Station was a wartime station set up by the Military Authorities for propaganda and was disbanded with the termination of hostilities. I was Chief Engineer of this station at that time and eventually secured employment with the Near East Arab Broadcasting Station. There is, of course, no connection between the two stations, but with the disbandment of the old *S.M.S.*, I was able to 'snaffle' some of its frequencies and equipment for use with my new employers . . . Present station is Arab-operated, using two *RCA*-4750 transmitters and two station-made 7½-kw. transmitters. I am also using a 2-kw. *Airaco* transmitter for test purposes on 3.320 and your reception report on the frequency is particularly interesting because I am using with it a vertical aerial of experimental design. Your reports on other Middle East stations are also very interesting and I would appreciate further information you can give on such transmissions."

Panama—HP5A, 11.695, Panama City, has *English* session at 1615-1715 Sundays; verie still gives frequency as 11.700. (Segal, via URDXC)

make henry your hallicrafters headquarters



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QUICK DELIVERY . . . Shipments 4 hours after receipt of order.

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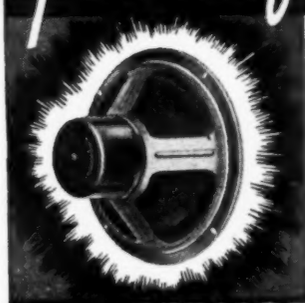

YOUR JOBBER CAN SUPPLY YOU!

Permoflux quality and dependability—the same as supplied to the major set manufacturers—is your assurance of complete customer satisfaction. You'll find Permoflux Speakers easy to install and readily available in both PM and Electrodynamic types. You'll find too, that it pays to give your customers "tops in tone" with a Permoflux Replacement Speaker.

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TUBES! TUBES! TUBES! THOUSANDS OF TUBES LOWEST PRICES!

(NEW, STANDARD BRANDS—DEALERS PRICES ON REQUEST—MINIMUM ORDER $5.00)

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
1A3	.96	5Z4	.89	6SF5	.79	14A7	1.10	100TH	12.95	832A	2.25	8020	5.95
1A5	.49	6A6	.75	6SG7	.79	14B7	1.10	100TS	3.00	833A	39.50	841	.69
1A7GT	1.10	6AB7	1.25	6SH7	.39	14H7	1.25	117L7	1.89	836	1.15	843	1.50
1B24	2.49	6AC7	.99	6SJ7GT	.69	14J7	1.25	117Z3	.89	837	2.50	8025	2.95
1B38	4.50	6AG5	.89	6SK7	.79	14R7	1.10	117Z6GT	1.10	838	3.75	9001	.89
1G4	.98	6AG7	.99	6SL7	.89	15E	1.50	121A	2.65	845	3.75	9002	.49
1G5	.44	6AK5	.69	6SN7GT	.69	23D4	.49	205B	4.50	860	3.00	9003	.49
1G6	.98	6AL5	.99	6SQ7	.89	23D6	.98	211	.98	861	50.00	9004	.49
1H4G	.98	6AQ5	.98	6SR7	.89	24G	.69	215A	3.00	866A	.75	9005	.98
1L4	.89	6AT6	.75	6SS7	.75	25A6GT	.75	217C	7.50	868	1.95	9006	.49
1R4/1294	1.29	6AU6	.89	6U5	.96	25L6GT	.75	250TH	17.50	872A	1.95	EE50	.79
1T4	.58	6B4	1.29	6V6GT	.99	25Z5	.75	304TL	2.49	874	1.95	HF100	3.95
1H5	.99	6B6G	.89	6Y6G	.89	25Z6	.98	307A	6.25	884	.75	HY75	1.25
1N5GT	1.10	6B6G	3.49	6Y6G	.89	28D7	.75	316	.89	923	.49	HY615	1.25
1LN5	1.92	6B8	.99	6X4	.98	30	.78	371A	1.39	954	.49	OZ4	1.25
1R5	1.10	6C4	.64	6X5	.89	32L7	1.50	731B	3.00	955	.49	RK60	.79
1S5	1.10	6C5	.51	7AE7	.75	34	.98	394A	4.50	956	.75	RK72	3.50
2A3	1.39	6C6	.75	7B7	.69	35L6GT	.75	417A	19.95	957	.49	T20	1.95
2C22	.69	6C21	12.95	7C4	1.50	35W4	.69	446A	1.25	958A	.49	TZ40	2.95
2C26A	.75	6D4	.89	7C5	.89	35Y4	1.10	450TH	17.50	959	.49	V70D	6.90
2C34	.98	6D8	.75	7E7	1.25	35Z3	.99	703A	7.50	991	.50	VR75	.95
2C40	2.60	6F6	.79	7L7GT	1.39	35Z5	.69	705A	1.85	1005	.39	VR78	.75
2C44	1.75	6F6G	.80	10Y	.69	36	1.10	713A	1.65	1006	.39	VR90	.75
2D21	.75	6F7	.96	12A6	.89	37	.69	715B	4.95	1613	.95	VR105	.75
2E22	1.50	6F8	1.10	12AH7	1.10	39/44	.59	717A	.69	1614	1.75	VR150	.69
2E25	3.95	6G6	1.10	12AT6	1.10	41	.69	721A	3.95	1616	1.39	Z225	1.95
2E30	2.25	6H6	.49	12BA6	.89	45	.64	723A/B	5.50	1619	.98	902	2.95
2J32	20.00	6J4	1.50	12BE6	.89	47	.90	725A	12.50	1622	1.75	2AP1	2.25
2J33	20.00	6J5	.49	12C8	.89	50B5	.89	800	2.25	1624	.98	3AP1	1.95
2JB5I	4.95	6J6	.49	12H6	.44	50L6GT	.75	801A	1.10	1625	.49	3BP1	1.95
2X2	.69	6J7	.89	12J5	.69	70L7	.89	802/RK25	1.49	1626	.49	3CP1	1.89
3A4	.49	6K6	.49	12K8	1.25	71A	.69	803	8.95	1629	.59	5AP1	2.49
3B7	.98	6K7	.59	12SA7GT	.99	75	.69	804	6.75	1630	.49	5BP1	1.49
3B22	4.95	6K8	1.25	12SG7	.89	75T	2.39	805	3.75	1631	1.49	5BP4	4.95
3B24	.98	6L6	1.25	12SH7	.89	77	.75	807	1.25	1641/RK60	.79	5CP1	3.95
3D6/1299	.89	6L6G	1.20	12SJ7	.79	78	.75	808	2.95	1851	1.25	5FP7	4.50
3E29	2.95	6L7	.98	12SK7	.69	79	1.10	809	1.50	2050	.90	7BP7	2.95
3Q4	1.10	6N7	.89	12SL7	1.10	80	.53	811	1.95	2051	.49	7DP4	14.95
3Q5GT	.58	6Q5	.98	12SN7GT	.79	82	.96	812	3.00	5514	3.95	7EP4	17.95
3S4	.43	6Q5G	.98	12SQ7GT	.99	83V	.89	812H	6.90	7193	.39	7GP4	19.40
4E27/257B	4.95	6Q7	.89	12SR7	.79	84	.75	813	5.95	8001	4.95	10CP4A	42.20
5R4GY	1.15	6R7	.98	12X3	.98	85	.89	814	4.39	8005	3.25	10BP4	37.50
5T4	1.25	6S7	.98					815	2.25	8011	2.95	10FP4	42.20
6AB7	1.25	6SA7	.90					829A/B	2.95	8012	4.95	10HP4 electrostatic	
5U4	.44	6SC7	.85					830B	5.25	8016	1.95	Tube	49.50
5V4G	.98											12JP4	60.00
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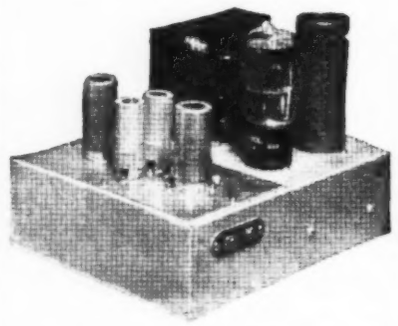
University Loudspeakers

Move That Television Station 30 Miles Closer! With a Magic View Preamplifier



Here's the preamplifier you need to put "fringe" installations into the service area of your favorite TV station. Designed to obtain the last ounce of signal-to-noise ratio out of **any single** channel, this amplifier uses the newest 9 pin miniatures for maximum gain in a push-pull grounded grid circuit.

By concentration on one channel per preamp, all losses due to tuning or switching are avoided, a high L/C ratio is maintained and remarkable gains (20 times on the high band, 30 times on the low band) are achieved.

Besides gain, the preselection gives freedom from local interference, such as FM, amateur, and short-wave, which cannot be approached by the best commercial receivers alone.

Installation requires a screwdriver and 117 volts a.c. to operate the self-contained power supply.

Write, wire, or phone your order, stating what channels you need (2 to 13 inclusive) and watch that television signal move in!

PRICE **$49.50** complete with tubes.

Catalog on television kits and components mailed free upon request.

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Philippines—KZFM has been heard in Texas on 11.840, announcing as "The People's Station" in Manila, poor signal and erratic, heard as late as 1000. (Star, Texas) Also reported by Dilg, California. *Radio Australia* has announced 6.170 is in parallel, but this has not been confirmed.

The Manila relay of "Voice of America" is scheduled on 11.890, 0400-1005, to Far East, and on 15.330, 0230-0345, to India and Pakistan (UN programs).

Poland—Warsaw schedules on 48.25 (approx. 6.215) are currently listed 1030-1900, with news at 1530-1550. (May be an hour *earlier* during summer.)

Portuguese Guinea—CQM-4, *Radio Bissau*, 7.947, has a fine signal in East 1630-1800, signing off with Portuguese National Anthem. (Southall, Pa.) *Radio Bissau* was scheduled to test on 16.667 at 0700-0800 on February 26, but was not reported to me as heard in America.

South Africa—SABC identifies in *English* and Afrikaans at beginning and end of *all* transmissions, says Mervyn P. Laubscher, our ISW monitor in South Africa, who sends these late schedules for SABC:

Johannesburg No. 4, 1 kw., 4.800, weekdays 2345-0130, 0900-1605, Sundays 0050-0110, 0945-1605, news 0000 (except Sun.), 0100 (BBC); runs to 1645 Sat. Johannesburg No. 4, 1 kw., 9.870, weekdays 0315-0710, Sundays 0313-0930, news 0615; on Tue., Thur., Sat. comes on 0245 with programs for Africans. Johannesburg No. 5, 200 w., 4.373, weekdays 2345-0130, 0315-0710, 0900-1605, Sundays 0055-0110, 0315-1605, news 0000 (except Sun.), 0100 (BBC), 0615, 1100 (BBC), 1200 (except Sun.), 1500; runs to 1645 Sat.; Tue., Thur., Sat. comes on 0245 with program for Africans. (This group normally carries programs in *English*.)

Johannesburg No. 3, 5 kw., 4.895, daily 1200-1605; news 1200 (except Sun.); runs to 1645 Sat. Johannesburg No. 3, 5 kw., 6.007, weekdays 2345-0130, Sundays 0055-0110, news 0100 (BBC). Johannesburg No. 3, 5 kw., 9.523, weekdays 0315-0710, 0900-1145, Sundays 0315-1145; news 0615; Tue., Thur., Sat. comes on 0245 with program for Africans. (This group normally carries programs in Afrikaans.)

Cape Town No. 3, 5.880, weekdays 2345-0130, 1200-1605, Sundays 0055-0110, 1200-1605, news 0100 (BBC); Sat. runs to 1645. Cape Town No. 3, 9.610, weekdays 0315-0710, 0900-1145, Sundays 0315-1145, news 0615. (These stations normally carry programs in Afrikaans—but the 9.610 outlet has *English* programs Wed. at 1320-1500.) Power is 5 kw. each.

Pietermaritzburg No. 2, 200 watts, 4.878, weekdays 2345-0130, 0315-0710, 0900-1605, Sun. 0055-0110, 0315-1605; news 0100 (BBC), 0615, 1200 (except Sun. when has news 1500); (normally

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RADAR ANTENNA

Makes Excellent Mechanism For Rotary-Beam Antennas

• Has 2 husky motors for azimuth & tilt variations—easily converted for 110v AC operation. Pair of precision potentiometers included for direction indicators. BRAND NEW—in original cases. An amazing bargain . . . ONLY $34.50 ea. (Conversion instructions included).

S-C-O-O-P — S-C-O-O-P!

New EIMAC VT-127-A.

Hard-Pumped. Will handle up to 15,000 Plate Volts.

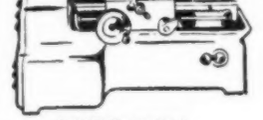
1,000 Watts Input on 6-Meters with a pair of these BRAND NEW Eimac triodes. (Similar to 100-TH, but heavier filament.) Fil: 5v at 10a. Platinum grid. **Surplus price, $2.45** ea., or 4 for **$8.40.** Filament Connector Blocks (brass) 25c pr.

25-WATT P-A SPEAKER

Get Ready for the Election Conventions

• Heavy-duty Jensen driver unit and UTC line-matching xfmr. 250, 500, 1000 and 2500 ohms. 20" long. 12" bell. Re-entrant type. Greatest P-A speaker value ever offered. **BRAND NEW. $21.60 net. Standard Crate of 2 Speakers $40.85** (Only a few left).

• This Zenith kit contains one 6E5 tube, socket, cord, 4-prong plug, (fits standard 6-prong socket) and tube shield-cone. **Brand New. SACRIFICE PRICE..98c ea. net.**



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• Regular price $60.75. Our special price, $41.50, **to liquidate overstock due to cancellation of export order.** A precision machine, 110v AC operation, with MOTOR and cooling fan. Automatic feed. Work capacity 3" between centers. Swing over bed 2". Price includes face plate, 2 lathe centers, tool post and rocker, and one dog. **BRAND NEW. IN ORIGINAL FACTORY CARTONS. $41.50 Net!**

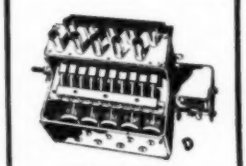
• Complete ACCESSORY KIT, including 4-jaw chuck, drill chuck, center countersink drill, 2 toolbits, 2 lathe dogs, 1 face plate with 8 drilled and tapped holes, 4 collets, 1 collet chuck, 1 Allen wrench. **FORMER PRICE $36.25. NEW LOW PRICE ONLY $24.50.**

• With each order for $10.00 worth of merchandise advertised on this page, you can buy one of these beautiful bakelite cabinets for only 98c additional. Ideal for receivers, intercomms, test equipment, control units, etc. (List price of cabinet $7.50).

• De-Luxe Superhet KIT, including everything—tubes, speaker, $7.50 value cabinet, loop antenna, dial, and ALL brand new, finest best-known parts. Standard circuit. A-V-C. 5-Tubes. Complete wiring diagrams with each kit. Nothing else to buy, $14.95. SPECIAL—4-Tube TRF Kit, fits same cabinet.....$11.85 (with $7.50 cabinet!)

POWER SUPPLY FOR ANY 274-N RECEIVER

Here it is—at last! Just plug it into the rear of your 274-N **RECEIVER** . . . any model! Complete kit, and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Designed especially for the 274-N receiver! (Resistance filter KIT $6.95) Standard model has choke filter. **$7.95**



PUSH-BUTTON TUNING UNIT

• Has 10 push-button keys, 10 variable condensers, (100uuf), padders, etc. **BRAND NEW.** Sold for one-third the value of condensers alone ..... **$1.95 net.**

B-C 211 Pwr. Unit

• Selenium rect., fil, xfmr. and all other parts, including case, wiring diagrams, etc. COMPLETE $5.85 net.

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Just Released—New Kits of Many Kinds

40-Meter Beginners' C-W Transmitter Kit, 150-WATTS

• Beautiful, **brand-new kit,** consisting of TU-10B unit in black metal case, 1 type-211 tube, 1 type-807, 1 50-watt socket, 3 variable condensers, 3 resistors, and ALL essential components. Everything complete, **less power supply.** Wiring diagrams and instructions in detail for adapting TU-10B Tuning Unit as 40-Meter Xmtr. **ONLY $9.85, WITH TUBES!** What a Buy!

INSTANT-ACTION INTERCOM KIT!!

• New, instant-heating tubes (operate only when talking) enable you to build a **PAIR** of the BEST intercom stations, EASILY and QUICKLY. Complete kit of **EVERYTHING,** all finest, **NEW** parts, wiring diagrams, instructions, PLUS two beautiful $7.50 value ea. bakelite cabinets, as shown at top center of this page. **ALL FOR ONLY $27.54 PER PAIR!, including RECTIFIER POWER UNITS, tubes, etc., etc.**

ELECTRIC SHAVER KIT

• Speed-up your shaver. Use D-C! Use our new, inexpensive **Rectifier Kit, especially** designed for this purpose. Complete kit with selenium rectifier, filters, cords, switch, socket, condensers and shielded case. **EVERYTHING FOR ONLY $3.26 net. Diagrams included.**

New D-C Filament Supply KIT. ELIMINATES 60-Cycle Hum & Hum-Modulation!

• Operate amplifier tubes, etc. from DC. Eliminate Hum! Improve quality of high-gain amplifiers, etc. DC Fil. Supply kit with selenium rectifier, condensers, resistors, switch, cord, etc, and WIRING DIAGRAMS. **150-ma Kit for 12-v. Fil. Tubes....$2.67 net 300-ma. Kit for 6.3v. Fil. Tubes..$3.80 net**

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• One of our best sellers! Useful, versatile laboratory item, in kit form. Simple, and easy to build in less than an hour. Checks condenser leakage and continuity up to 8-megs. Will test any paper, electrolytic, mica or oil condenser from 50-uuf. to 50-mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled Metal Cabinet. Complete instructions and diagrams included with each kit. **ONLY $4.85**

400-V. 200-MA. POWER SUPPLY

• Fits in palm of your hand. Complete power-supply KIT, with 3 selenium rectifiers, and ALL parts, finest best-known brands, and 160-mfd in condensers. Voltage-tripler circuit. Delivers 300-v under full load. Drilled metal shield can. All diagrams and instructions included. **BRAND NEW $8.85**

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VC-6	$ 9.65	$ 2.80
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VC-100	25.74	7.65
VC-150	39.83	11.60
VC-200	48.46	14.60
VC-250	57.92	17.30

All In Original Factory Cartons, ALL GUARANTEED UNCONDITIONALLY!!

COMPONENT KITS

• Standard Cartons of Finest, nationally-known brands. Stock-up now at these all-time low prices. Limited quantities. First come, first served!

Resistors

• 100 most practical sizes and values, ½, 1 & 2-watts. 50 ohms to 8 megs. Allen-Bradley, IRC, Continental, etc. Every one BRAND NEW, perfect in every respect. This is truly a GREAT BUY. **Kit of 100 for ONLY $1.95**

Condensers

100 of the finest C-D Aerovox and Solar capacitors, all 600 working volt sizes, ALL BRAND NEW. Assortment includes .01, .02, .05 and .1-mfd. sizes. **Imagine it—the entire lot for only $6.90.**

Tie-Pins

Another mighty useful kit of assorted tie-pin connectors, various sizes and types. Excellent assortment of dozens of 1, 2, 4 and multi-lug types. NOT SURPLUS, but brand-new products . . . at new low price of only $1.00.

Relays

• A box-full of BRAND NEW, perfect, guaranteed 12-volt and 24-volt relays of various types and sizes, (sixteen assorted types) offered to you for the worth of the silver contacts alone. Every relay is a standard product. **NO OFF-BRANDS. A $50.00 assortment for ONLY $4.95 net. Only a few on hand.**

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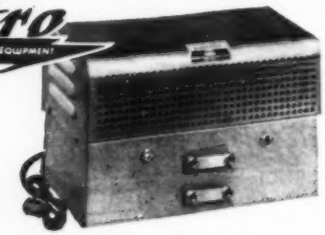
MODEL "A"



*6V at 15 amps. in parallel
*12V at 7½ amps. in series
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Height: 7¾". Length: 11¾".
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Operates auto radios with solenoid tuning and tone controls—also 12 volt marine and aircraft radios from 115v., 60 cycle supply.

Oversize transformers, chokes and rectifiers insure against overheating. Large capacity condensers for wide-range voltage regulation. Instantaneous power for solenoid operation. Two separately filtered DC output sources.

Compact. Sturdy. 18-gauge steel construction. Handsome blue Hammerloid finish. Comes completely equipped including 6′ rubber cord and plug. Vastly superior and costs no more than batteries for equal service.

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RADIO NEWS

185 North Wabash Avenue
Chicago 1, Illinois

carries programs in Afrikaans, but carries *English* programs weekdays from 1500, Sundays from 1300); runs to 1645 Sat.; Zulu session daily 0245; Indian session on Sun. at 0215 prior to Zulu period. Transmitter is located at Pietermaritzburg, but all programs originate in the Durban studios.

Mr. Laubscher adds that call-signs have not as yet been allocated to SABC.

ZRB, 9.110, Pretoria, is reported heard irregularly in East around 0000; appears to open at 2345, relaying SABC. (Kary, Pa.) Heard in Ohio at 0100-0130. (Sutton) Also heard on West Coast. (Dilg, Baxter) And in Texas. (Stark)

Spanish Morocco—Radio Tetuan, 6.067, is scheduled 0230-0330 (*except* Sunday); Spanish first half hour, Arabic second half. (Beck, N.Y.) Heard in Newfoundland signing *on* 1600. (Peddle)

Sumatra—Major, Western Australia, lists a Sumatran station on 7.220, heard with good level at 0730. Radio World, Australia, says location of the Indonesian heard around 0630 (presumably on about 7.220) is Fort de Kock, East Coast of Sumatra.

Surinam—Arthur, W. Va., notes that recently PZH5, Paramaribo, has been using 5.757, replacing 5.843, and paralleling 15.402. Latter is listed 15.405 by the station but is actually lower.

Station lists schedule Mon.-Sat. 0930-1100, 1700-2200, Sundays 0930-1300, 1700-2200. (Southall, Pa.) (It is possible these listings are *not* EST, in which case *subtract* a half-hour.—K.R.B.)

Sweden—Arthur, W. Va., reports SDT2, 15.665, Motala, has been heard lately with news pickups, probably around 1800-1930.

Switzerland—The "mystery" station on 6.345 is the International Red Cross, Geneva; scheduled Wednesdays 0145-0230 in German to Austria; 0230-0300 tests in French, *English,* German; also daily 1245-1445, presumably on same frequency. (Beck, N.Y.)Has been heard well in New Zealand, asking for reports. (Clark) Has been heard in Northwest. (Park, British Columbia, Canada)

Syria—Damascus is building three new powerful s.w. transmitters. (Pearce, England) Schedules are listed as 0000-0100, 0700-0800, 1100-1500. The 12.000 (approx.) outlet is heard in Newfoundland at 1215-1445. (Peddle) Reported heard in Eastern U. S. around 0000-0100.

Tangier Zone—Radio Internationale, 6.200, has *English* at 1500-1530. (Peddle, Newfoundland)

U. S. A.—The World Wide Broadcasting Foundation (WRUL), Boston, Mass., recently announced power would be increased to 250 kw. (Southall, Pa.)

U. S. S. R.—Moscow's North American morning transmission, 0745-0815, is being radiated on 6.11, 7.26, 9.54, 9.57, 11.72, 15.17, 17.77. (Southall, Pa.)

Vatican—HVJ has not been heard lately on West Coast at 1000 when formerly carried news. (Dilg) The 15.095 outlet has news at that time, has been signing off at 1015. (By now this transmission is likely heard one hour *earlier* for the summer.—K.R.B.)

Yugoslavia—Radio Belgrade, 6.107, is heard in Newfoundland with news 1530-1545. (Peddle) Also has news at 1230; French news 0745, 1430; German news 1445; Spanish news 1615. (Hansson, Sweden)

* * *

Last Minute Tips

Radio Espana Independiente, believed located somewhere in the Soviet Union, is heard in Newfoundland, with poor modulation, in Spanish at 1230-1245 on 13.65 at 1330-1345 on 8.76, and at 1530-1545 on 9.255. (Peddle)

In a second letter to Kary, Pa., Director Fu Hwa Hau, of XMPA, Nanking, reaffirmed that he is quite anxious to receive reception reports. It is possible this station can still be heard early mornings. Frequency is 12.220 and schedule is 1800-1900, 2300-0100, 0430-0930. QRA is Radio Station XMPA, Chinese Army Radio Service, 10 Snake Mountain, Nanking, China. Clark, New Zealand, says this station is heard well there at 0545 with news in *English*.

LQX, Gamma Islands, Melchior Archipelago (South Shetlands), has been heard contacting Buenos Aires, Argentina, at 1700 on 12.330 (varies), announces as "Antartida Argentina." LQX2, Deception Island, has been heard contacting LSD9, Buenos Aires, 18.115, at 1800 on 14.820 (varies), dictating commentaries which are recorded by LSD9. (Villela, Brazil)

ZSS, (approximately 15.8) Cape Town, South Africa, has been heard in England around 0835 contacting GBC, London, on open circuit, then going into inverted speech to 0845. (Brownless, England)

Cushen, New Zealand, reports *Radio SEAC* moved to 17.730 from 17.820 due to having interfered with a BBC outlet on latter channel. (Radio Australia)

The unidentified Chinese station (call may be XUPB?) on about 6.11 relays the XGOY news 0900. (Balbi, California) Sometimes call sounds XGFP. (Dilg, California)

YV1RC, 6.150, "Radio Cabimas," Cabimas, Venezuela, is a *new* station heard evenings. YSCP, 5.200, San Salvador, El Salvador, is a *new* station heard 2000-2100. HCQRX, 4.985, "Radio Quito," Quito, Ecuador, has moved here from 6.000. YV9RA, 4.820, "La Voz de Apure," San Fernando de Apure, Venezuela, is a *new* station, heard evenings to 2130 sign-off. HC4FS, 4.560, "La Voz de Esmeraldas," Ciudad Esmeraldas, Ecuador, is a *new* station, heard to 2300 sign-off. YV6RK, 3.330, "La Voz del Tigre," El Tigre, Venezuela, is a *new* station heard evenings to 2130 sign-off. (Legge, N.Y.)

The Communist-controlled Chinese outlet, XNCR, 7.945 (varies), North Shensi, has been poor lately, audible on West Coast around 0630, carries news 0640, followed by Western music, signs off 0700; XGHT, another Communist outlet, 6.065 (varies), signs off 0830. (Dilg)

Canada's International Service now "speaks to the world by short-wave regularly in ten languages, and this service will be expanded to reach an even larger audience during the coming year," officials of CBC state.

QRA for KZBU, Cebu, Philippines, is Philippine Broadcasting Co., Gotiaoca Building, Comercio St., Cebu City, Philippines; the station wrote Gillett, Australia, verifying his report and stating it was the first one received from outside the Philippine Republic; slogan is *"Cebu Calling,"* and by now the station should be operating 18½ hours per day (probably from around 1630 to around 1105). Gillett says KZRC, also Cebu, is heard opening on 6.135 with fair to good signals 1600, and KZRH, 9.64, Manila, is an excellent signal when testing prior to opening at 1600.

CR6AA, 7.177, Lobito, Angola, is scheduled weekdays 1130-1530, but Sunday schedule is not definitely established.

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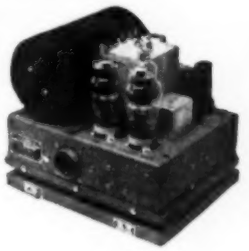

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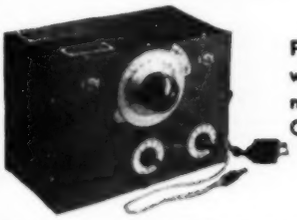

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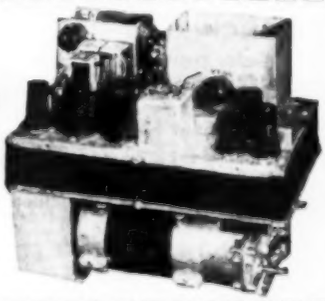

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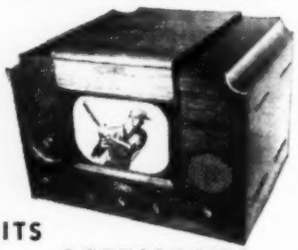

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The *Radio Clube de Huilla,* 9.230, a new Angola outlet, is heard in South Africa around 1300-1330, but with weak signal. Lourenco Marques, Mozambique, has been heard testing on Saturdays on 9.71 at 0700-0900, preparatory to extension of schedules which may by this time be 0700-1700 weekdays and 0200-1700 on Sundays; 9.710 will probably be used to around 1100. It is noted that SABC (South Africa) has eliminated its 1545 relay of BBC news. (Laubscher, South Africa)

XLRA, 11.500, Hankow, signs off at 1000, signals are fair to good. Manila's KZFM, 11.84, has news 0500 and signs off 1000. PLY, 10.060, Java, is being heard again to 1030 (irregularly, *not* heard daily). *Radio Tabriz,* 6.105, is heard to 1000, weak to fair. (Balbi, California)

The "mystery" surrounding location of XGAS, 11.680 and 7.105, deepens. A report just in from Major, Western Australia, now gives it as Chung Chin. Earlier, Major listed it to me as Changsha, and New Zealand sources say location is Kungchun (may be same as Chung Chin). (*If anyone can clear up this matter, please advise your ISW Editor.*) Incidentally, Major says the station signs off at 1000 with an orchestra playing "Anchors Aweigh," followed by a chorus, with *no* announcements in *English.*

Kary, Pa., has received word from a Danish correspondent (Friis) that by this time Denmark's new short-wave transmitter should be on the air "with regular transmissions to the East on wavelengths from 13-20 meters and to North and South America on 30-40 meters." No other details. Other late tips from Kary are:

Reports from Jerusalem for American networks are now coming direct from that city instead of being relayed via land-line to Cairo transmitters. A frequency of about 19.203 (drifts) is used with a call of ZNT-18 (may be a Cable & Wireless station), generally heard around 0800 weekdays and 0900 Sundays. TGZA, Zacapa, Guatemala, appears to have a nightly schedule of roughly 2103-2310; signs on with marimba music, usually announces in Spanish but sometimes identifies in *English* as "TGZA, the *Oriental Radio* of the city of Zacapa in Guatemala, Central America, transmitting on 6655 kilocycles." Measures 6.660. A "mystery" station previously reported on 7.788 but more recently heard on 7.790 around 1900-2150 sign-off, rather strong signals, may be Stalinbad, Soviet Union. Is heard well here in West Virginia. Has usual deep hollowness of Soviet stations, often a clock is heard ticking, and there are frequent periods of long silence (with carrier on).

-[30]-

HOW TO TAKE TELEVISION PHOTOGRAPHS

By LESLIE ORTON

Editor, Radio Entertainment World

England

TO PHOTOGRAPH people miles away is quite simple if you have a television receiver and a camera. You merely have to photograph people appearing upon the television screen!

However, to make a decent job of it, it is advisable that the operator have some knowledge of the construction of the picture on the screen. Most of us know that when we see a movie at the theater we are actually observing a number of still pictures, with slight differences, which are cast upon the screen at such speed that, through the persistence of our vision, appear not as individual still pictures but as a moving picture. In some ways this description applies to television pictures.

Looking at the screen we observe a moving picture. Take a camera and photograph that picture at a high speed and we see recorded, not a picture, but a spot of light for television pictures are made up of a spot of light which travels the screen at high speed, varying in intensity in response to impulses radiated from the transmitting station and picked up by the receiver. (In actual fact that "spot of light" may appear as a part of a picture through the retention of light, after the spot has passed, by the sensitized material used to coat the screen or blunt end of the cathode-ray tube.)

Thus it is clear that in order to obtain a photograph of the whole picture an exposure sufficiently long to enable the spot to traverse the complete screen must be made.

British television pictures are scanned at a rate of 25 pictures a second while American pictures are scanned at the rate of 30 per second. Therefore, in order to obtain the correct exposure on a single picture we must photograph at one twenty-fifth of a second for British pictures and one-thirtieth of a second for American pictures.

The aperture of the lens will naturally vary in accordance with the brilliance of the picture recorded and the speed of the plate or film employed.

Finally, it cannot be too strongly emphasized that the speed of taking is all important. It should be borne in mind that if too great a speed is employed in taking television photographs, very peculiar effects may be obtained, while if too slow a speed is chosen a blurred picture will result.

—30—

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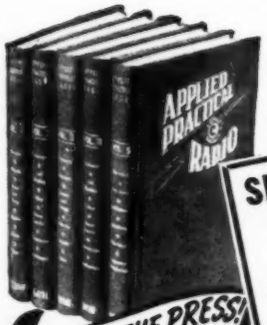

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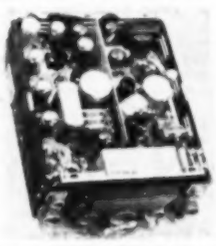

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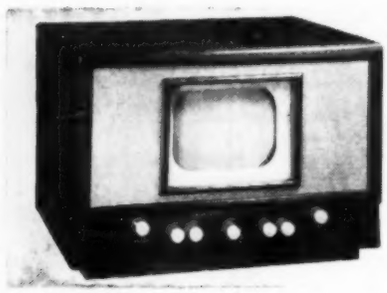

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Trough Line Tuner

(Continued from page 65)

the information given in Fig. 4.

The location of the tube sockets is extremely important if the shortest leads are to be obtained. It will be observed that when this plate is placed over the tuning condenser, the small tubular shield in the center of the tube sockets comes exactly in contact with portions of the condenser frame. These should be soldered to the frame at these points. A small additional brass shield should be soldered to the condenser frame at the point indicated in the photograph Fig. 1.

In Fig. 1, four points marked *X* will be observed. These are ground lugs which must be carefully soldered to the plate on which the tube sockets are mounted. This tube mounting plate is also soldered to the frame of the condenser at all four corners.

These ground lugs form part of the trimmers in the tuning condenser, and care must be used in soldering. If too much heat is used, the trimmers will fall apart. It is advisable to hold the lugs with a pair of long nose pliers while soldering.

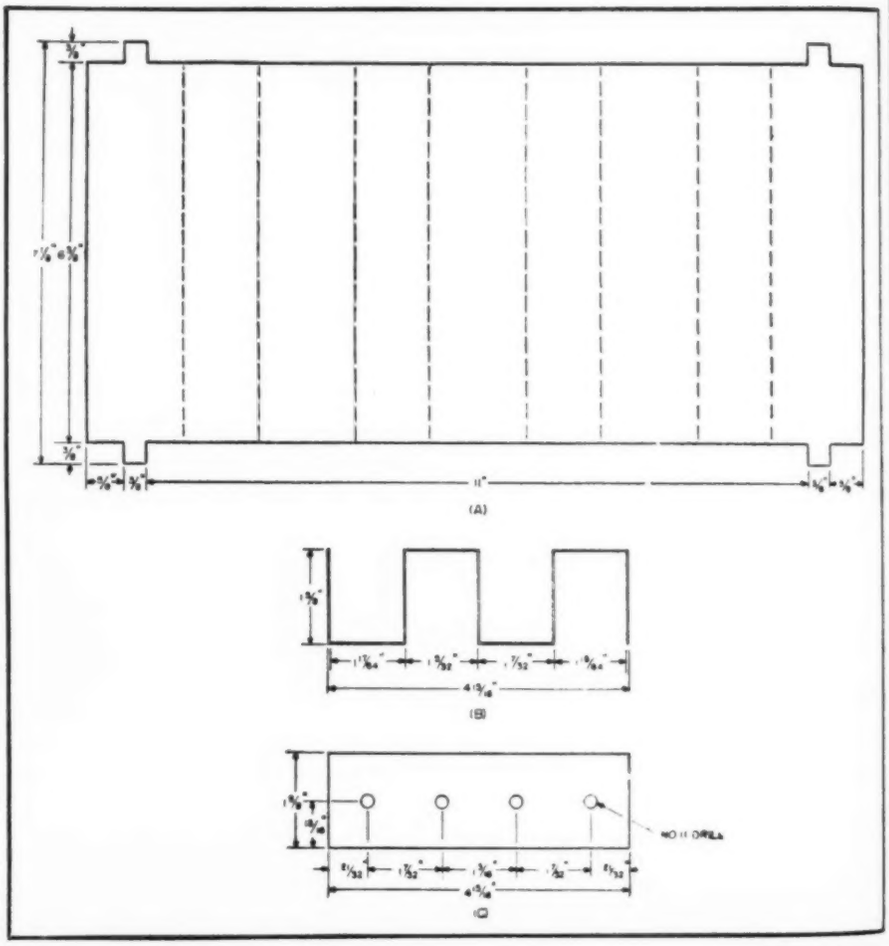
The center conductors shown, which are marked "inner gut" in Fig. 1, are made of ¼" brass tubing and are threaded at their lower end with a ¼/28 thread and clamped to the base plate with a pair of nuts.

These lines are soldered to the opposite set of lugs on the trimmer condensers. After soldering, 3/16" holes should be drilled through the lugs supporting lines 2 and 3 to permit the wire inside the lines to be passed through the lugs.

Fig. 4 shows a *Wheaton* seal going through the mounting plate for the plate connection to the first i.f. transformer.

No connections for an antenna or transmission line are shown in the drawing. If a coaxial line is employed, a fitting may be mounted as shown in Fig. 1, and the center conductor of the coaxial fitting should be soldered directly to the inner gut at a point 1¼" for a 50 ohm line and 1⅜" for a 72 ohm line. If a two-wire line is employed a hole may be drilled at a point indicated by the large dot directly to the left of the antenna connector at a distance from the connector equal to the width of the two wire line. One side of the transmission line may be cut one inch shorter than the other. Solder the short end of the line to a point on the outer shield designated by the dot, after passing the short end of line through the hole. Pass the long end of the line through a rubber grommet inserted at the point indicated by the dot and solder to inner gut at a point

Fig. 6.



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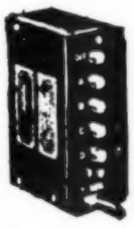

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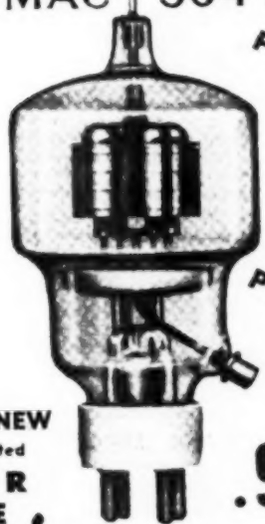

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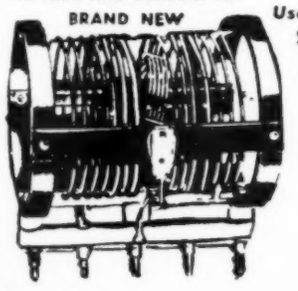

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1¾" from base plate. These dimensions have been found by experiment to give best results.

It will be noted that no form of coupling has been provided between the oscillator and mixer sections as sufficient oscillator energy is present without it, and there is no pulling of the oscillator.

-30-

POLARITY RESPONSE FROM RADIO TUNING EYE TUBES

By NATIONAL BUREAU OF STANDARDS

THE use of electron-tube tuning indicators for balance or null detectors is well-known. The necessity for polarity-sensitive tuning indication in frequency modulation reception has given impetus to the development of the new 6AL7-GT indicator tube featuring a dual column type of presentation. For instrument work, however, a balance indicator capable of greater precision is frequently desired. By means of the circuit shown in Fig. 1, M. L. Greenough of the Electronic Instrumentation Laboratory, National Bureau of Standards, has adapted a conventional "magic eye" tube of the variable shadow angle type, such as the 6E5, 6U5, 6N5, etc., to furnish a polarity-sensitive indication. Although this circuit was developed for instrument application, it may be of value for adapting a conventional tuning eye to balance indication in FM discriminators.

The obvious method of making the "magic eye" tube polarity-responsive is to bias the deflection grid to produce some arbitrarily chosen reference angle, which is marked on the scale over the tube. Positive or negative signals then cause an increase or a decrease of this shadow angle. The disadvantages of such a system are the instability of the reference angle, which is greatly dependent upon the supply voltages, and parallax of observation. These disadvantages may be avoided by repeatedly switching the signal on and off at a rate fast enough to prevent visible flicker, for example, at power line frequency. By this means two shadow angles are maintained on the tube screen itself. One shadow angle, corresponding to zero input, appears half the time, while during the remaining time the angle is that due to the amplitude of the applied signal. Zero signal input is indicated when the edges of these angles coincide.

Typical patterns obtained for positive, zero and negative signals are shown in Fig. 2. There appears to be a half-illuminated angular sector whose width is proportional to the deflection signal, and which lies on one or the other side of a reference line as determined by signal polarity. Alternatively, the pattern may be considered as two superimposed areas of half-illumination, one fixed and one variable. The edges of these areas are similar and sharp in the 6E5. Their superposition at balance can be precisely observed. Accurate null indication is maintained in spite of supply voltage variations, since such changes merely affect both illuminated areas identically. Using reasonable care it has been found possible to repeat observations of balance to less than 0.05 volt with the unaided eye. A simple lens permits resolution approaching an electrically imposed limit, which in this case was measured to be approximately 7 millivolts. Although no extended study of ultimate balance limitations has been made, higher magnification and improved switching circuits could undoubtedly provide higher resolution.

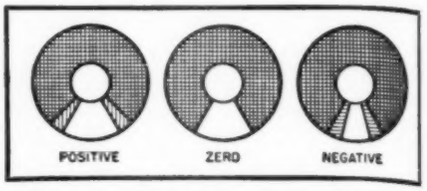
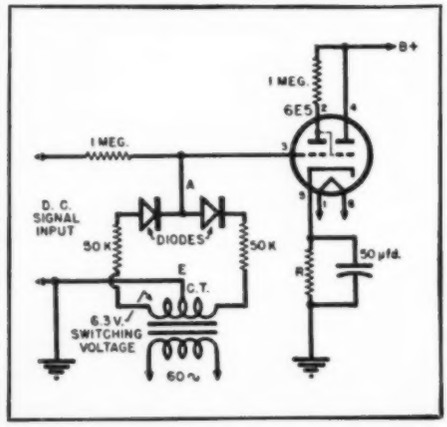


Fig. 2. Typical patterns on 6E5 indicator tube when rendered polarity-responsive by circuit shown in Fig. 1.

In the circuit shown in Fig. 1 the diode network acts effectively as a switch which is opened and closed during alternate half cycles of the 60-cycle "switching voltage." The d.c. input signal is applied across the 1-megohm resistor in series with the resistance of the diode switching circuit between point A and ground. The voltage across the diode switching circuit is applied to the grid of the tuning eye. During the half cycle of switching voltage which renders the diodes conducting, the resistance between point A and ground is low relative to 1 megohm. This permits a negligible fraction of the input voltage to appear between point A and ground. During the half cycle of diode non-conduction, the resistance of each diode is increased to its reverse voltage value, and nearly the entire input voltage appears between point A and ground. Due to the symmetry of the diode network, none of the switching voltage appears between point A and ground.

In this circuit diodes of high quality, particularly with regard to back resistance, provide maximum sensitivity of indication. Miniature dry disc rectifiers for example, 7 ma. selenium or copper oxide units having more than 10 megohm back resistance, have proved satisfactory. -30-

Fig. 1. Circuit diagram for obtaining polarity-sensitive indications with 6E5 tuning indicator tube. Cathode resistor, R, is determined by plate supply voltages.



Two-Way Radio

(*Continued from page* 41)

without feedback than in the conventional single superheterodyne, yet reducing the hazard of spurious responses so common to double superheterodyne receivers unless carefully designed.

A two-way mobile unit consists of a separate transmitter and receiver with associated power supplies or a transmitter, receiver, and power supply all in one housing. A hand microphone or handset and a control unit are usually mounted on or near the dashboard of the vehicle. Transmitter-receiver units vary in size from almost the entire capacity of an automobile trunk to the size of an ordinary brief case. Mobile antennas usually consist of an 18" rod or wire mounted on the auto roof in a vertical position and connected to the transmitter-receiver unit through flexible coaxial cable.

The power output of commonly available two-way mobile units varies from 2.5 to 30 watts. The amount of power required has been widely argued, but today in the same cities various makes of equipment are used on the same channel with equal results. The higher powered units, of course, put out stronger signals but to the FM receiver at the land station, a 1 watt or 50 watt mobile unit will sound just as loud, provided the frequency swing is the same. Although in many cases, users of low powered equipment report ranges as great as that obtained with higher powered units, there is no doubt that the higher powered unit should be able to provide slightly greater range, particularly, in case of adverse locations.

Mobile receivers are often duplicates of land station receivers, whereas some manufacturers have designed more compact receivers for mobile installations. The general electrical design is the same as in land station receivers. Vibrator type power supplies are most commonly used in mobile receivers.

To reduce the nuisance of having all operators as well as passengers in vehicles equipped with mobile units hear all of the transmissions emanating from the land station as well as all other land stations on the same channel in the same service area, means for selective calling or lock out of unwanted transmissions are being provided by some manufacturers. Dial systems can be employed to select desired mobile units only. Transmission of various tones and combinations of tones is being used to select the desired mobile unit.

One of the simplest, yet most effective, selective calling systems provides for the transmission of a tone from the land station to turn on the loudspeakers of all cars in a group or fleet. When the land station operator wishes to call a specific mobile unit, he operates his control unit so it will auto-

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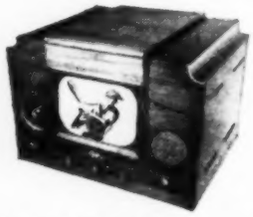

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matically transmit a tone for a fraction of a second at the start of the transmission. This tone unlocks the squelch circuit of all the mobile units equipped with filters for that particular tone. The land station operator's voice is then heard over the loudspeakers of these mobile units.

The driver of the desired mobile unit then picks up his handset, and acknowledges the call. For the rest of this communication, the land station operator puts his transmitter on the air without the tone. The loudspeakers in all of the mobile units are then silent and the land station can be heard only through the handset.

The aggressive radio technicion with the required technical qualifications and equipment is in demand right now. Taxicab operators in particular are in need of the assistance of capable technicians to install and maintain their radio equipment. Manufacturers of two-way radio equipment are anxious to locate qualified technicians who can be referred to their customers. As the urban mobile radio field expands, the demand for technicians will increase beyond its present critical stage. There are service contracts available to radio technicians who are ready to handle the two-way radio service business.

At the time of writing, the taxicab companies using radio are all operating on the same frequency. In reality, they are using two frequencies, 152.27 megacycles at land stations and 157.53 megacycles at mobile units. By using two separate frequencies for cross channel operation, mobile units cannot communicate with one another because their receivers are tuned to the land station frequency. Neither can two land stations communicate with each other unless a monitor receiver is employed. Although most land stations are not equipped with monitor receivers, under a strict interpretation of FCC rules, each station should have a monitor receiver so it could determine that the air is clear before transmitting. At present, two or more stations do go on the air at once with the result that serious interference is caused. In one of the country's largest cities, a power war exists. Taxicab operators have increased the power of their land stations so they can get through the interference, but they in turn are creating more interference. One of these stations can be heard 60 miles away, which is many times farther than is required. Rather than respect the rights of their competitors, these stations come on the air at will even if the other fellow is already on the air. If monitor receivers were employed, and the owners of the stations would cooperate, the use of radio in taxicab dispatching would be more effective for all concerned. No doubt, when more channels are assigned for taxicab service, and when the service is established on a regular basis, the FCC will police the service to prevent such abuses of the privilege of using radio.

Fixed-tuned v. h.f. receivers are already available and more will be

available soon for monitoring purposes. A superregenerative receiver may be used for monitoring purposes as this type of receiver will demodulate FM. Another method of cooperative use of a channel is to use a leased telephone line between land stations operating on the same channel. When one station is on the air, a lamp will light at the other station, indicating that the channel is busy, or the line may be used to operate interlocking relays that will prevent one transmitter from going on the air while the other is in use.

FCC Applications

A radio technician entering the field of mobile radio maintenance should be familiar with FCC rules and regulations as well as the procedure to be followed in applying for construction permits and licenses. Complete information on this subject may be obtained by writing direct to the Federal Communications Commission in Washington, D. C.

Operators of land stations must hold a third class radiotelephone license, often referred to as a restricted radiotelephone permit. The need for an examination for this grade of license has been waived. It is now only necessary to apply for the license by mail on the new type forms issued by the Commission. Knowledge of the laws governing radio is required but no technical knowledge is necessary. However, anyone actually making adjustments to a transmitter must possess either a first or second class radiotelephone operator's license which requires a written examination.

The need for qualified service stations to maintain two-way mobile radio equipment is growing every day. Qualified men with the proper equipment have a golden opportunity. Now is the time to enter this field to get in on the ground floor. One way of starting would be to write to the various manufacturers of two-way radio equipment stating your qualifications. These manufacturers in turn can contact you when one of their customers in your vicinity is in need of installation or maintenance service.

The rates being charged for installation service vary with companies and localities. A fair price for the installation of a mobile unit in an automobile is about $15.00. Some firms are charging $25.00, and others less than $10.00. However, a lot depends on the make of equipment and the make and condition of the automobile. When installing equipment in a large fleet of cars, production line methods can be used with the result that the installation cost per car will drop. Land station installation charges will vary with the equipment. $50.00 to $100.00 seems to be a fair price. However, installation of the antenna or erection of an antenna mast is not included in these figures.

Many fleet operators using two-way radio are contracting for maintenance service on a monthly-per-car basis. In one instance, the radio service agency

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1U5	36	30	7N7	49	44
1V	45	39	7Y4	44	35
1L4	55	49	7X7	44	35
1T4	69	55	7AF7	44	35
1S5	69	55	12A6	35	25
2A7	49	39	12A8GT	45	37
2A5	65	55	12AT6	50	45
2A6	49	39	12BA6	50	45
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3A4	69	59	12J5GT	35	27
3S4	69	59	12J7GT	45	39
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5W4GT	40	36	12K8	65	55
5Y3GT	40	33	12Q7GT	45	39
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5X4G	40	37	12SQ7GT	40	32
5Z4	59	49	12SK7GT	45	35
6A7	50	45	12SR7	39	34
6A8GT	49	39	12SJ7GT	55	49
6AC5	98	92	14A7	65	55
6AC7	65	60	14B6	59	49
6AK5	74	69	24A	49	39
6AG7/6AK7	89	79	47	49	39
6B7G	55	49	57	45	39
6C4	29	25	58	45	39
6C5GT	40	35	71A	39	29
6C6	45	32	75	50	39
6C8G	37	29	76	45	39
6F6GT	45	39	77	35	27
6H6	45	39	80	40	38
6J6	95	50	83V	99	89
6H6GT	45	39	85	49	45
6J5GT	45	39	99V	35	25
6J7GT	42	38	99X	35	25
6K6GT	45	39	25L6GT	49	39
6K7GT	49	39	25Z5	49	45
6K7G	50	41	25Z6GT	45	39
6L6G	79	69	35W4	43	40
6Q7GT	47	39	35Y4	43	40
6S7	59	48	35Z3	44	35
6U7G	35	25	35Z5GT	43	39
6V6GT	45	39	35L6GT	45	39
6X5GT	49	39	35/51	49	39
6SA7GT	44	37	50L6GT	50	45
6SH7GT	40	32	117Z6GT	89	76
6SJ7GT	44	37	50B5	42	32
6SK7GT	49	39	32L7GT	59	49
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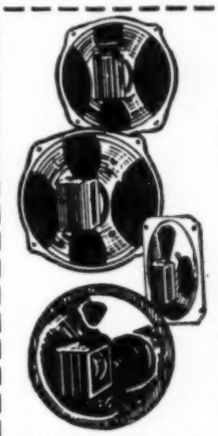

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This radio servicing handbook is easy-to-read and easy-to-understand. It breaks the superheterodyne into natural stages, and analyzes it thoroughly from a service standpoint, covering everything from setting up the signal generator to the push-pull output stage. Attention is given to the most commonly used testing equipment — the multimeter and signal generator. Schematic diagrams help make this book a practical on-the-job manual.

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is charging the fleet owner $10.00 per month per car covering one monthly preventative maintenance check-up and an unlimited number of emergency calls. Tubes and parts are extra. In another case, the radio firm is charging $12.00 per month per car, including tubes and parts. A compromise might be considered at $5.00 per month per car for preventative maintenance, plus an hourly charge for additional service call, plus tubes and parts.

In order to make any money in two-way radio maintenance, it will pay to have the fleet owner purchase at least one spare mobile unit for every ten cars. When a unit needs maintenance, a new unit may be slipped into the car and the radio technician can pick up the defective unit at his leisure. In his shop, he should have test jigs and equipment so he can repair the defective unit quickly so it will be ready as a stand by. Working on the equipment in the car is not only difficult, but also ties up the car.

Most manufacturers will be glad to supply technical information on their equipment to interested radio service organizations. These same manufacturers will also be able to suggest makes and types of test equipment most suited for mobile radio maintenance. If you have personnel, the technical qualifications, and proper licenses, now is the time to investigate this new source of business—two-way mobile radio maintenance.

—30—

Signal Generator

(Continued from page 51)

quency possessing the same stability and accuracy as the 100 kc. standard. At any frequency in the entire range of the instrument the signal may be modulated with an internally generated 400 cycle audio tone. The signal output level is adjustable from a panel control. An output cable brings the signal to where it is needed. The tubes employed in this unit include a 50B5 crystal oscillator, 12AT6 a.f. oscillator, and a 50B5 as a rectifier. The crystal controlled generator operates from a 110 to 120 volt a.c. or d.c. power line.

This unit has many applications. As a source of accurate frequencies for the alignment of radio receivers, the generator can be used for r.f. and i.f. frequencies in the broadcast, short-wave and v.h.f. ranges. Receiver manufacturers can use this crystal controlled source of frequencies as a production alignment tool for fixed frequency stations on the production line. It may also be used as a check frequency source for v.f.o.'s in operation on production or maintenance benches.

As an aid to FM receiver alignment the unit will provide i.f. and r.f. frequencies when crystals of the proper frequencies are employed. For example, with a crystal at 10.7 mc., dis-

THE FOLDED DIPOLE ANTENNA

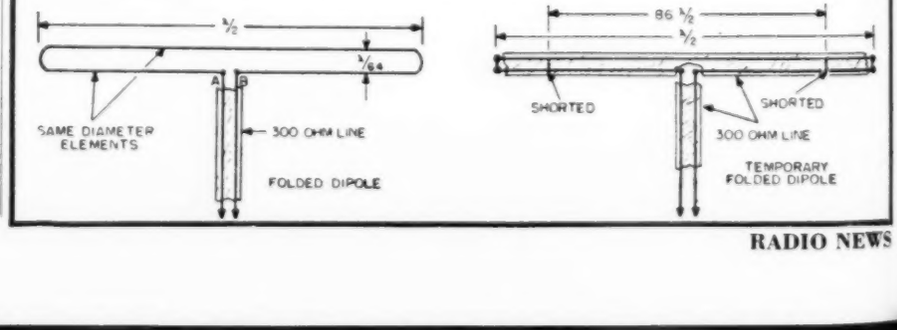
By EDWARD M. NOLL

THE folded dipole, with equal diameter elements, is a 300-ohm antenna which conveniently matches the standard 300-ohm receiver input and the 300-ohm twin-line transmission line. In addition, it is a broad-band unit which has a uniform sensitivity over a wide band of frequencies. Thus, the folded dipole presents an efficient match and does not detract from the picture resolution. The folded dipole is a half-wave antenna comprising a full wavelength of line bent around to form two parallel lines. Spacing between the elements of the antenna is λ/64 or less. Dimensions are given in the chart.

Antenna resistance can be varied by changing the diameter of one element with respect to the other. When the diameter of the fed element is decreased with respect to the other element, antenna resistance increases. If the diameter of the fed element is increased, antenna resistance decreases. Antenna resistance can also be increased by increasing the number of elements.

A folded dipole for temporary or test use can be constructed of 300-ohm twin-wire line by cutting a half-wave section and opening one element at midpoint for feeding as shown in the diagram. Although the antenna is a half-wave long, it must be shorted at the 86 per cent point, as indicated, because of the lower velocity constant of the dielectric. The extremities can be either open or shorted.

CHANNELS	1	2	3	4	5	6	7	8	9	10	11	12	13	L	H
Full-wave A to B	240	197	173	163	144	134	63	61½	59½	57½	55½	54¼	53	168	57½
λ/2 element	120	98	86	81	72	67	31	30½	29¾	28¾	27¾	27	26½	84	29¼
λ/64 spacing	4	3¼	3	2¾	2½	2¼	1	1	1	1	1	1	1	2¾	1



criminators and ratio detectors can be aligned to their respective center frequencies. A 10.8 mc. crystal and one at 10.6 mc. can then be used successively to check the balance in the negative and positive directions, in addition to the band limit amplitudes. The 10th harmonic of the i.f. crystal frequency provides the frequency for the alignment at the h.f. end of the r.f. section of the FM receiver. A 10.8 or 10.6 mc. crystal would be best to use in this case since the 10.7 mc. crystal will ride through the i.f.

For television receiver alignment a group of five crystals can be employed at the five frequencies equal to one-half the frequencies required for stagger-tuned i.f. peaking. *RCA* receivers are aligned at 21.8 mc., 22.3 mc., 23.4 mc., 25.2 mc., and 25.3 mc. Ordinary peaking methods are employed with an amplitude modulated single frequency at the above points. To use the signal generator in this way five crystals are required; at 10.9, 11.15, 11.7, 12.6, and 12.65 mc. These will double to the desired frequencies. In addition to the above, a crystal for tuning each of the trap frequencies to minimum would be useful. In *RCA* receivers these frequencies would be 19.75 mc., 21.25 mc., for which the crystal frequencies for doubling would be 9.875 mc. and 10.625 mc. Each crystal is inserted in the front panel receptacle as it is needed, and no further adjustment of the generator is necessary, except, where required, to lower or raise the output level with the control (R_1) provided. Where peaking adjustments are being made, the set is trimmed for maximum detector output (or a.v.c. voltage) at each of the peak frequencies and when trap adjustments are made the traps are tuned for minimum output at the trapped frequencies. The 10.625 mc. frequency can be used for sound i.f. alignment at 21.25 mc.

With a crystal at 100 kc. this unit can be used as a secondary standard. Aligned by zero beating against WWV at 2.5 mc. or at 5.0 mc., the 100 kc. frequency can be used as a direct source of harmonics at 100 kc., or, as a sync generator for a multivibrator. A similar application for higher frequency use would employ a 1000 kc. crystal or one at 5.0 mc. or 10 mc. In each instance, after alignment by the zero beat method against WWV's standard frequency transmissions, harmonics of the fundamental crystal frequencies can be used up into the v.h.f. region.

Television receiver local oscillators can be adjusted to their proper fixed frequencies for each channel by use of crystals at a lower frequency with a harmonic at the desired frequency. For example the channel 4 local oscillator in recent *RCA* receivers is set at 93 mc. by zero beating it against the 10th harmonic of a 9.3 mc. crystal. A prewar television receiver would have a channel 4 local oscillator setting of 80 mc. This can be adjusted against the 10th harmonic of 8.0 mc. or 8th harmonic of 10 mc. —30—

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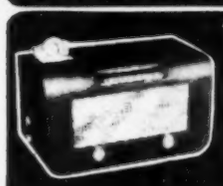

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Technical BOOKS

"PREPARING FOR FEDERAL RADIO OPERATOR EXAMINATIONS" by Arnold Shostak. Published by *Prentice-Hall, Inc.*, New York. 384 pages. Price $3.75.

This handbook is both concise and authoritative. Written by a former radio inspector for the Federal Communications Commission, this text is prepared in the familiar "question and answer" form. The book is divided into six elements corresponding to the elements encountered in the FCC examinations.

Representative questions, along with the correct answers, are included under each element. In some instances where the answer is long and relatively complicated, shortened versions of the replies are also given.

Three appendices have been included covering rules governing commercial radio operators, extracts from the Communications Acts, and a table of abbreviations.

Replies to the technical questions are fairly complete and include the necessary mathematics.

This book is admirably suited for home study by prospective licensees and applicants for a renewal of FCC licenses.

* * *

"TELEVISION PRIMER ON PRODUCTION AND DIRECTION" by Louis A. Sposa. Published by *McGraw-Hill Book Company*, New York. 226 pages. Price $3.50.

This is a practical "how-to-do-it" handbook for video program technicians, directors, makeup and wardrobe personnel, lighting men, etc.

Mr. Sposa, who is Director of Commercial Operations for station WABD, has drawn on his long and varied experience in the field in preparing this handbook. Detailed discussions cover all phases of television entertainment including programming, scenic designing, lighting methods, art work, titles, video effects, microphones and their use, televising motion pictures, etc.

The book is clearly written in nontechnical language and is lavishly illustrated with studio shots and line drawings. This text should prove valuable to personnel of both new and established video stations as well as students in training for careers in television.

* * *

"FM TRANSMISSION AND RECEPTION" by John F. Rider and Seymour D. Uslan. Published by *John F. Rider Publisher, Inc.*, New York. 404 pages. Price $1.80 paper.

This book has been divided into two main sections dealing with FM transmission and FM reception. The authors have provided a detailed explanation of the equipment and techniques used in transmitting FM program material including transmitting antennas.

While this material provides an excellent background for the all-around technician, servicemen will undoubtedly find the section dealing with FM receiving equipment of more immediate value. Receiving antennas are covered in some detail in a separate chapter with consideration being given to half-wave dipoles, folded dipoles, dipoles with reflectors, and other types of FM receiving antennas.

The chapter dealing with FM receivers discusses the similarities and differences between AM and FM receivers, the r.f. stage, mixer-oscillator and converter systems, sensitivity and selectivity, the i.f. system, demodulation-detection, the limiter stage, the discriminator detector, the double-tuned discriminator, the phase discriminator, the ratio detector, a.v.c. from ratio detectors, oscillator detectors, comparison between detector systems, the audio system, and FM tuners.

Servicemen will welcome the chapters dealing with the alignment and servicing of FM receivers. Procedures are carefully outlined and complete details for performing the various operations are given. An appendix covering vectors, powers of ten, the FreModyne circuit, FM ground wave signal range, i.f. response curves and a reactance tube chart provide a handy reference for the serviceman.

Since the inclusion of mathematics has been limited to the barest essentials, this book may be used by the student and for self-instruction.

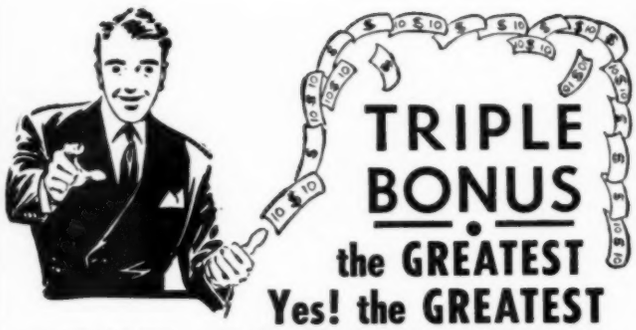
* * *

"BROADCAST OPERATORS HANDBOOK" by Harold E. Ennes. Published by *John F. Rider Publisher, Inc.*, New York. 262 pages. Price $3.30.

This book meets a long-felt need for a practical working guide for broadcast station engineers. The material is designed and written to be used either by the student engineer or by the "old hand" who would like to learn better ways of doing his job.

The text is divided into six parts, a bibliography, and an appendix. The first four parts of the book deal with operating practice in control rooms, the master control, remote controls, and the transmitter. The fifth and sixth parts are technical in nature and provide technical data for operators and technicians. A particularly valuable chapter is devoted to preventive maintenance.

Since this book is written by an operator, for operators, the style is informal and couched in operating language. Those of our readers who have read Mr. Ennes' articles in the RADIO-ELECTRONIC ENGINEERING edition of RADIO NEWS already know and appreciate his lucidity and grasp of his subject. —30—



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RADIO FILTER new FL-8-A, ea.....75c
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Within the Industry
(*Continued from page* 30)

the aptitude and experience of the usual plant maintenance personnel.

An Engineering Department is also maintained to conduct electronic research and development and to perfect new test equipment and techniques as they are developed.

This organization operates nationally and has 10 district offices located throughout the United States.

* * *

A. M. SKELLETT, Director of Research for *National Union Radio Corporation,* Orange, New Jersey, has been appointed Vice President in charge of the Research Division.

Dr. Skellett joined the Research Division of *National Union* as Chief Engineer in 1944 after spending 15 years as a member of the technical staff of the *Bell Telephone Laboratories.* He is a consultant to the Research Development Board in the Department of National Defense of the Federal Government.

* * *

ROBERT J. HARRINGTON has been appointed Assistant Director of Sales for *Industrial Television Inc.* of Clifton, New Jersey.

Prior to joining *Industrial,* Mr. Harrington was Secretary-Treasurer of *American Time Corp.* of Springfield, Massachusetts. He was formerly associated with *Allen B. DuMont Laboratories, Inc.*

In his new post Mr. Harrington will act as assistant to Edwin C. Hinck, the company's Sales Director.

* * *

ROY BROWN UNGER of the *Ward Products Corporation,* manufacturers of radio, television, and auto antennas, has been promoted to the post of sales manager.

Mr. Unger, who served as a first lieutenant of artillery in the Pacific area, was formerly assistant sales manager of the jobber division of *Ward Products.*

Among Mr. Unger's new duties will be an advertising promotion campaign for the company's new FM and television aerial line.

* * *

DR. W. R. G. BAKER, of the *General Electric Company,* representing the Radio Manufacturers Association, was elected vice-chairman of the Electrical Standards Committee of the American Standards Association. Charles R. Harte, of the *Connecticut Company,* New Haven, Connecticut, representing the American Transit Association, was re-elected chairman of the committee.

The Communications and Electronics Section will be under the chairmanship of Dr. Baker while the Power Section will work under the chairmanship of Sidney Withington, chief electrical engineer, *New York, New Haven & Hartford Railroad Company.*

The Electrical Standards Committee of the American Standards Association is the central body for standardization in the United States in the electrical, communications, and electronics field.

New members of the Executive Committee and their organizational affiliations are: L. F. Adams, *General Electric Company,* (NEMA); P. H. Chase, chief engineer, *Philadelphia Electric Company;* L. J. Cumming, technical secretary, IRE; J. J. Pilliod, assistant chief engineer, *American Telephone and Telegraph Company,* (A.I.E.E.); Colonel L. J. Tatom, Commanding Officer, Army Electronic Standards Agency; and C. R. Welborn, executive vice-president, *Underwriters' Laboratories.* —30—

Recording of Sound
(*Continued from page* 61)

R^{22} appears, a negative voltage is applied to the grid of V^2, tending to reduce the transconductance of the tube and reduce the magnitude of the degenerative voltage in its plate circuit. This means that a large input signal to the noise suppressor will produce sufficient negative voltage on the grid circuit of the reactance tube to lower the effective gain and the magnitude of the degenerative voltage in its plate circuit. For this reason the circuit is effectively tuned to a higher frequency when the tube is shifted toward cut-off. These same principles apply to the low frequency reactance tube V^3 except that the signal applied to its grid is produced by a network consisting of a shunt capacitance C^{10} and the resistor R^{14}. This produces a predominance of low frequencies in the grid circuit and a corresponding low frequency degenerative signal in the plate circuit.

The inductance CH^2 is selected to make this circuit resonate sharply to produce a sharp cut-off instead of the roll-off that would be obtained with only an effective shunt capacitance, represented by the reactance tube V^2.

S^1 is used to eliminate the 10 kc. filter under conditions of no suppression and opens the cathode circuit of both reactance tubes, cutting them off completely and eliminating any effect from them. Thus the circuits are virtually eliminated under conditions of "no suppression". In tuning these circuits the procedure is to switch S^1 to the "on" position and unsolder the lead from the

bottom part of S^1 that goes to R^{10}. This leaves the series filter in the circuit but eliminates the reactance tubes. Now, feeding an oscillator (set to 10 kc.) into the input of V^1, tune C^2 for a maximum dip at 10 kc. Next disconnect R^4 from the plate of V^1, switch S^1 to the "on" position, reconnect the lead from R^{10} to the bottom part of S^1, and connect a temporary short across the upper terminals of S^1 (across C^2) thus eliminating the 10 kc. filter but making the reactance tubes effective.

With R^5 set for minimum resistance in the circuit and the oscillator set for approximately 4500 c.p.s., tune C^8 for a maximum dip at this frequency. An output meter may be used for this purpose but it is better to observe the output on an oscilloscope. Now it will be found that adjustment of R^5 to introduce an increasing amount of resistance in the circuit will effectively tune the maximum attenuation dip toward higher frequencies. This adjustment is used in operating the Dynamic Noise Suppressor to determine the frequency where the gates cut-off when they are closed completely. With very good records this control may be operated with almost a maximum of resistance introduced so that the cut-off even when the gates are closed will be above 4500 c.p.s. while with very poor records it will be desirable to operate the control for minimum resistance so as to cut off at lower frequencies. This control may be ganged with S^1 although this is complicated by the availability of suitable components. Under conditions of no suppression, S^1 of course should be used in the "off" position.

In order to observe the operation under effective dynamic conditions, it is necessary to employ two oscillators. One oscillator is fed into the input of the 6B8G and the other oscillator is connected between R^4 (at the point where it was previously disconnected from the plate of V^1) and the cathode of V^1. Now with the output of the oscillator which is connected to R^4, set at zero, the oscillator fed to the input of V^1 is adjusted to provide a signal at, say, 4500 c.p.s. with S^1 in "off" position. With R^5 set for minimum resistance in the circuit, switch S^1 to the "on" position.If the output is observed on an oscilloscope during this procedure the signal will be observed to be greatly attenuated when the switch is operated as indicated.

The output of the oscillator connected to R^4 should now be adjusted to approximately 2000 c.p.s. and the output level slowly increased. It will be seen that this will effectively drive open the gates and bring the 4500 c.p.s. signal back in the direction of no attenuation.

The point at which the noise suppressor circuits are connected in any given

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DYNAMOTORS

Model 515 Transmitting: Output 500 V. @ 50 Ma., $2.69; 2 for.....$5.00
Model 516 Receiving: Output 275 V. @ 110 Ma., $1.69; 2 for..... 3.00
One of each type..... 4.00
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DM-416 Input: 28 V. @ 3.1 Amps. Output: 330 V. @ 170 Ma. (Navy Type). Filter assembly in base. Mounting included. New.....$1.49

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PE-125 BX for SCR-223. Input: 12 or 24 V. Output: 475 V. @ 200 Ma. A heavy duty unit built for continuous service. Complete with 2 RK-60 Rectifier tubes, Spare vibrator, Shock Mount and Plug. Ideal for Mobile installations on cabs, trucks, buses, etc. New. Ready for operation $8.95

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0-500 VDC @ 1000 ohms per V. 3" Round..... 2.49
0-10 output units (1.25 Ma. F.S.) in wood case. 2½" Bakelite case (Less thermal unit)..... 2.19
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Bias Meter I-97A-Zero center, 3" Bakelite case. Reads 115 VDC and 100 Ma + or —. Mounted in sturdy steel case, 5" H., 7" L., 4½" D. Contains cond., trans., plugs, cords and many useful parts. Diagram included. A giveaway $4.95
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POTENTIOMETERS (Name Brands)

Dual Unit. Wirewound, with dial plate and knob. Front section: 1200 ohms @ .35 Amps. Rear section: 3 ohms @ 4.7 Amps. Air-cooled. Includes mounting bracket. New $1.29
Dual Unit. Carbon, 4 megs each section. Shaft extends ½". Standard ⅜" mounting..... 49c
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Four Gang. Carbon, 1" shaft. Front to back: 6000; 2500; 30,000; 30,000 ohms. Well-made. Sturdy construction 79c
Aircraft Type. 500 ohms wirewound. Enclosed in heavy cast aluminum case. ¼" shaft. Amphenol connector terminals. Only 49c
Rheostat. 90 ohms baked enamel wirewound. Air-cooled in metal case. ⅝" Mtg. ¼" shaft. 1" long. 0.35 Amps. NEW only 59c
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Assorted .....Lb. 75c

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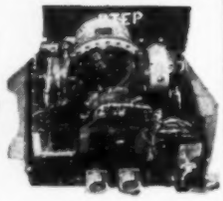

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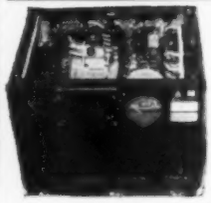

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amplifying system is, of course, extremely important. If they are connected too near the input and with excessive gain following them, the hum pickup from the inductances may be amplified to an irritating level. If they are connected too far back in the amplifier, the drive to the grids of the reactance tubes may introduce distortion. If the drive to the reactance tube grids is too high, a certain amount of grid rectification will take place with serious distortion. This may be readily observed on the oscilloscope by observing the output in the attenuated regions blown up sufficiently on the screen to see the waveform.

If the circuits are properly adjusted, there will be no observable distortion at any frequency. If the gates are being overdriven, the waveform in some sections of the attenuated region will be seriously distorted. This distortion will be evident under conditions where the gates are driven partially open by a control voltage, but will not appear when the gates are driven fully open. Such an indication clearly shows the introduction of the distortion by the gate tube circuits. If the input signal is of the correct magnitude, this will not be observed and the signal will be entirely clean in all sections of the spectrum under all conditions of gate circuit operation.

It will be clear that this distortion is not a problem of the same kind that is introduced in various volume expander circuits where a variable mu tube is used as an amplifier. The function of the reactance tube circuits is concerned with the proper *percentage* of the signal being fed to the grids and the principles will hold for any given amount of signal supplied, provided it is not so high as to cause grid circuit rectification. Consequently, the operating point with regard to signal amplitude may be chosen to preclude the possibility of distortion on peaks and yet be sufficient so that excessive amplification is not needed in following circuits. This condition is also less troublesome because on peaks where distortion might be otherwise introduced (if the choice of signal amplitude is not optimum) the gates are driven open and the reactance tubes effectively made inoperative. Then any distortion that might be present is observable only under conditions of attenuation. This is not intended to indicate that the distortion introduced by an excessive signal level to the gates is unimportant, but that it is not always easy to observe and should be watched for and investigated with care.

This version of the Dynamic Noise Suppressor will provide, with optimum adjustments, satisfactory operation out to approximately 6000 cycles. If it is desirable to increase the roll-off, where the majority of records played have unusually poor signal-to-noise ratios, a small condenser may be inserted from the junction of R^6 and R^7 to ground. This may approximate 250 $\mu\mu$fd. and will also aid in holding down any tendency of the resonant circuit to permit a rise above cut-off. If it is desirable to broaden the response range, an additional reactance tube may be used instead of this condenser and the values may be approximately the same as those for V^2.

The inductance CH^2 is not necessary in such a circuit. If very wide range response is desired, additional complete filter sections may be added, tuned to increasingly higher cut-off frequencies. In either case the control voltage to these additional circuits may require an additional section of filtering in order to eliminate possibilities of in-phase signals to the grids of the reactance tubes, producing oscillation or distortion. Abrupt surges in the plate circuit of the low frequency reactance tube may appear in the output of the amplifier, if the low frequency response is extremely good and this may be minimized by the choice of value for C^{12} or other coupling condensers. If it is introduced by the filtering characteristics of the control circuits, it may be controlled by an additional filter section. Resistors R^{23} and R^{22} determine the closing speed of the gate circuits and may be changed in value by the individual designer in order to produce faster or slower closing of the gates. These may be reduced to as low as one megohm or even a half megohm. Optimum values will depend to some degree on the taste of the listener, the importance of reverberation in the type of recordings most played and the signal-to-noise ratios of the average records to be reproduced.

Volume Expansion

If the reactance tube circuits are adjusted so that the effective *"Q"* of the circuit is poor, there will be a large resistive component. This means that the shunting effect of the circuits under conditions of closed gates will be apparent to some degree at all frequencies. Consequently, when the gates are driven open the response at all frequencies will be increased to some degree. This effect may be deliberately introduced to produce volume expansion. One way to accomplish this is to change the resistor from screen to ground in the low frequency reactance tube circuit. Adjustment of the screen voltage for maximum *"Q"* is fairly critical. In general, it is desirable to minimize the effect of volume expansion to 2 db. or less. The effect may be deliberately introduced by inserting a potentiometer in place of the screen-to-cathode resistor. The value should be around 10,000 ohms and varying this resistor will produce varying

degrees of volume expansion. As much as 15 db. may be obtained. The expansion will take place simultaneously with the opening of the gate circuits. In these circuits it must be remembered that a really complex effect is obtained if the frequency response and over-all amplitude is being expanded simultaneously. The desirability of this effect, except in very limited amounts, is questionable.

Although this version of the Dynamic Noise Suppressor does not permit sufficiently broad-band response to provide maximum frequency response from transcriptions and commercial pressings of exceptional quality, it does permit superior results on average records over what may be obtained with conventional tone controls. Most commercial records do not have appreciable response in the very high ranges. If it is borne in mind that many very high quality theater sound systems are not required by the signal available to reproduce frequencies beyond approximately 7500 c.p.s., and that music reproduction in high quality theater installations from sound on film is considerably closer to reality than the very great majority of phonograph record reproducers, it will be evident that a system capable of actually reproducing a flat response to 6000 c.p.s. with contribution beyond this frequency, and a minimum of noise, will do a very satisfactory job of reproducing most records, and will be very much superior to the average commercial machine that cuts off abruptly at 4500 c.p.s. in order to minimize noise.

Most of the component parts values are critical, particularly the chokes, CH^1 and CH^2. Therefore, no attempt should be made to substitute either tubes or parts.

Some practice in using the Dynamic Noise Suppressor will be necessary in order to take full advantage of the results it is capable of giving.

(To be continued)

TV OUTPUT UP

OUTPUT of television receivers for February reached a new high of 35,889, according to data released by Radio Manufacturers Association on production by member-companies.

This tops the previous high of 30,001 reached in January of this year. Total production of television receivers since the war now numbers 250,937 units.

More than two-thirds, or 25,594 of the February TV set production were table models, the remainder being consoles and radio-phonograph combinations.

FM-AM receivers reported by member-companies for February totaled 140,629 or an increase of 4614 over January, but still below the monthly average of the last quarter of 1947. About 36 per-cent of the FM-AM units were table models and converters.

Over-all set production by member-companies reached 1,379,605 units of all types in February. -30-

A Sensational New Invention That Will Revolutionize Television: A Liquid Magnifying Lens Using New Patent Principle Allowing Vision From Any Angle Up To 180°

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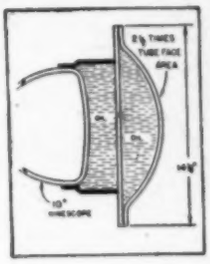
The Liquid Lens Corporation magnifier. The black collar connects the kinescope with the lens. Space between the fluorescent screen and magnifier screen is filled with oil.



Cross section sketch of the coupling arrangement and oil chambers of the liquid lens.

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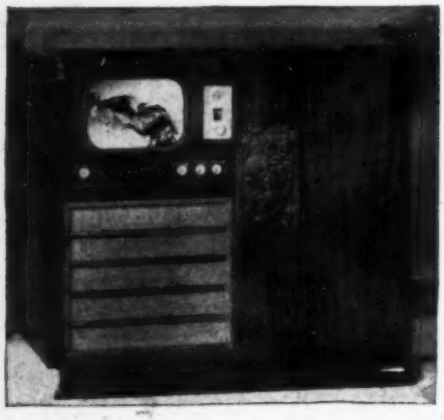
NEW RECEIVERS ---------- on the Market

TV CONSOLE

Stromberg-Carlson has recently introduced its combination radio-phonograph-television unit, the Model TV 12 M5M.

Known as the "Chinese Classic", this receiver provides a large screen with 12



inch picture tube in addition to FM, AM, and short-wave reception. The receiver is continuously tunable through the complete range of video and FM frequencies. A tuning eye has been included for accurate station selection and optimum reception.

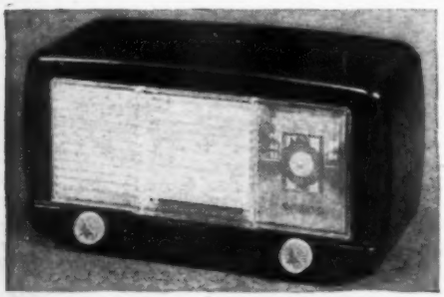
A twelve-inch electromagnetic speaker is mounted in live rubber. Push-button tuning is provided on the standard broadcast band. The record changer plays 10 or 12 inch records in sequence and stops automatically after the last record has been played.

For further information on the Model TV 12 M5M address requests for data to *Stromberg-Carlson,* Rochester, New York.

TABLE RADIO

Housed in a two-piece plastic case, *Garod* is presenting the new "Elite" Model 5A3 table model receiver in the moderate price class.

The five-tube a.c.-d.c. superhetero-



dyne features the "Air-Tenna" loop which insures reception over the entire broadcast band. The illuminated full-vision dial has highly visible markings for ease in tuning. Controls include a tuning knob, and a volume control and "on-off" switch.

The cabinet measures 12½ inches by 6⅞ inches by 5⅝ inches.

Garod Electronics Corporation, 70 Washington Street, Brooklyn 1, New York is the manufacturer.

MODERN CONSOLE

Freed Radio Corporation has recently introduced the *Freed-Eisemann* "Modern", a conservatively styled console combination which is available in bleached or brown stripe mahogany finishes.

The "Modern" incorporates a 21 tube radio with Armstrong FM, a separate power supply and audio amplifier with an undistorted output of 20 watts, and coaxially mounted dual speakers with a tonal range of 30 to 15,000 cycles.

An automatic record changer that plays 10 and 12 inch records in any sequence and that employs a new type wide range pickup and a matched semi-

permanent needle is located in a pull-out compartment.

Additional details on the "Modern" may be secured by writing *Freed Radio Corporation,* 200 Hudson Street, New York, New York.

15" TABLE TV

A new addition to the *United States Television* line of home receivers is a 15 inch direct view table model designed especially for long-distance reception.

Housed in a mahogany cabinet, the 15 inch direct view set provides a picture measuring 9½ by 12¾ inches. The cabinet measures 22 inches by 22 inches by 23¾ inches.

Daylight operation of the set is made possible by several advanced features. New automatic circuits lock the picture in synchronism with the transmitter. Only four controls are required to operate this set. An r.f. amplifier, four stages of picture i.f. amplification, and two stages of video amplification are provided for better interference immunity, greater sensitivity, and noise free reception.

FM sound reproduction is achieved by use of three stages of i.f. amplification. An Alnico V permanent magnet speaker gives good sound reproduction.

Further details of this new 15 inch

table model receiver may be secured by writing *United States Television Mfg. Corp.,* 3 West 61 Street, New York 23, N. Y.

PHONO CONSOLE

J. P. Seeburg Corporation of Chicago recently introduced the "Select-O-Matic Library" to the trade.

This instrument, which is available in models for the home and industry, plays records vertically and supplies more than fourteen hours of continuous music without repeating a selection or requiring any attention from the listener.

The new unit permits instant choice of any one of 200 selections without touching a record or searching for the desired selection in an album. Either or both sides of a record may be played without the recording being touched or without the record being turned over.

The instrument removes the record from the library, places it in a vertical position and then returns it to the library. Programs may be played automatically in any predetermined time cycle by means of a program timer set by the listener.

The model for the home has been designated the Model SLBA-1 and is housed in a modern cabinet of light wood.

Further information on the Model SLBA-1 may be secured by writing to *J. P. Seeburg Corporation,* Chicago, Illinois.

ARVIN PORTABLE

One of the new portables being introduced in the new *Arvin* line is the Model 240P.

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POLIN SALES

3806 Wilson Ave. Chicago 25, Ill.

This little 4-tube battery portable is housed in a ruby red thermo-plastic case and leads the line of personal portables being offered by the company.

Full details on the Model 240P and other receivers in the new line may be secured from *Noblitt-Sparks Industries*, Columbus, Indiana.

SIGHTMASTER VIDEO

Sightmaster Corp. of New York is now offering a 15" television receiver with FM radio.

Housed in either a mahogany, blonde, or walnut cabinet, the Model 15-C-11 features twin speakers. The circuit uses 24 tubes plus a 15" direct view tube which provides a picture area of 120 square inches.

The television receiver covers all channels in any television area while the FM tuning range covers from 87 to 109 mc.

Sightmaster Corp., 220 Fifth Ave., New York 1, New York will supply additional details on the Model 15-C-11 upon request.

RCA VIDEO CONSOLE

The *Home Instrument Department* of *Radio Corporation of America* is now merchandising a new, low-priced console model television receiver which provides a 52 square inch picture on the face of a 10 inch direct-view tube.

Available in both walnut and mahogany finishes, the new console is of contemporary design, featuring clean lines, a permanent flat top, and fine horizontal louvers protecting the grille. Dimensions of the unit are 40½ inches high, 20 inches wide, and 20 inches deep. Performance features include the company's "Golden Throat Tone System" with a 12 inch electro-dynamic speaker, the "Eye Witness Picture Synchronizer", the "Automatic All-Channel Station Selector Switch", a three-stage i.f. video amplifier, and a two-stage i.f. audio amplifier.

The *Home Instrument Department, Radio Corporation of America*, Camden, New Jersey will supply additional details on the Model 721TCS upon request.

PORTABLE WIRE RECORDER

A unique portable wire recorder and phono-combination has been announced by *Air King Products Co., Inc.* of Brooklyn.

This unit uses 5 tubes (including rectifier) in the amplifier and has a radio attachment cord. The recorder will play either 10 or 12 inch records and comes equipped with a permanent needle.

Recordings from a phonograph or radio can be made directly through the amplifier without using the microphone thus guaranteeing highest fidelity. Voice can be dubbed through the mike while recording from the radio, if desired.

Housed in a luggage-type carrying case, the wooden box offers excellent baffle qualities yet is compact and practical. An automatic shut-off whereby the motor turns off after the wire rewinds has been incorporated in this unit. A safety lock prevents accidental erasures and a visual tone indicator guarantees proper recording level.

Further details on the Model A-750 may be secured from *Air King Products Co., Inc.*, 170 53rd Street, Brooklyn 32, New York.

AM-FM CONSOLE

Templetone Radio Mfg. Corp. is currently introducing its Model G-1430, a 14-tube radio phonograph console which incorporates FM, AM, and short-wave reception.

The automatic record changer plays mixed 10 and 12 inch records in any order and shuts off after the last record has been played. A 4 second change cycle is a feature of this changer.

A 12 inch Alnico V permanent magnet dynamic speaker is capable of handling the peak power output of 40 watts. A four-position switch tone control, bass, music, voice, and treble, changes the tone by boosting bass and/or treble, not

merely attenuating the high frequencies.

A data sheet covering the features of the Model G-1430 is available on request from *Templetone Radio Mfg. Corp.*, 220 E. 42nd Street, New York, New York.

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Spot Radio News

(*Continued from page 20*)

named WORM. Belongs to the Easton Broadcasting Company, Inc., Easton, Md., FCC says. The station, authorized for 1-kw. operating on 1480 kc., is now abuilding. WORM will broadcast seventeen hours daily under the guidance of J. N. Critchlow, its president, with the help of his two sons, John N. and Roger E. Critchlow.

IT'S DIFFICULT to predict too accurately at the moment, but you can bet on this—the Federal government will be a big radio customer before the snow flies. Maybe not as big a customer as, say, during the closing years of the war, but plenty big, nevertheless. Preparedness is the answer—plus the fact that military thinking is becoming more and more electronics-conscious. This has, of course, been standard for years with the Signal Corps (now busy on new communications devices, the lighter and more mobile, the better), but top brass in other services now have the bug. Significant is the off-the-record statement to this correspondent by a high-ranking Air Force General recently: "Maybe some of us fliers don't know it yet, but I can assure you it's true: the outfit with the best electronic devices, *not* the best planes, is going to win the next war." He's backing this up with all the influence of his office, which is a key one, to streamline the Air Force along electronic lines as quickly as possible. As this goes to press, there was every indication that a sizable portion of the huge Air Force budget would be given to him to implement his idea with full-

"TOPS ALL DX RECORDS"

A message from LEO WØGFQ . . .

Hams the world over are praising the WRL-275 watt Globe King XMTR Kit. The WRL-275 watt Globe King is a versatile advanced design transmitter kit which will give you efficient performance on 6, 10, 20, 40, and 80 meter band on phone and CW. COMPARE THESE FEATURES AND TAKE ANOTHER LOOK AT THE PRICE. Front panel control of link to final input—automatic fixed bias for good regulation—voltage controlled buffer and oscillator stages—provisions for ECO—new speech modulator circuit—modulates up to 350 watts—dual power supply for oscilator buffer and RF stage—most compact transmitter on the market—stands 28½" high. For only $20.00 we wire this kit complete ready to go and all you have to do, in most cases, is hook on your antenna, plug in your mike and you're on the air. Write for complete descriptive literature—plus names of users in your area.

Harlan DeWitz
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Harlan WØDHO writes: "I have been teaching my WRL 275 Globe King XMTR on all bands with wonderful results. In my 20 years of Hamming, this is the finest for the money I have ever seen or used." Harlan DeWitz, WØDHO Wisner, Nebr.

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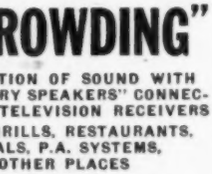

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throttle research and development work, followed closely by large-lot orders of the resulting equipment.

PERHAPS TYPICAL of current defense thinking—and indicating how far they intend to go into electronic fields—was the recent development of a weather facsimile service for transmitting weather maps. Signal Corps played a leading role in this work, done for the Air Force Air Weather Service, by developing a service that would be invaluable to combat units of all types as well as to non-combat groups interested in advancing a war effort. The facsimile service—among the most ambitious military projects since war's end—involves some 15,000 miles of circuits, with four separate networks of facsimile transmission channels. The networks are so arranged that they can be interconnected and one station can send to all receiving stations. Domestic as well as international weather maps are prepared at the weather headquarters in Arlington, Virginia, across the Potomac from Washington and in the shadow of the Pentagon. They are broadcast on an almost half-hourly basis throughout the United States. Regional maps are distributed from secondary transmission points in New York, California, Texas, Oklahoma and Georgia. Facsimile makes transmission of a map possible in about twenty minutes. According to Air Force authorities, facsimile will have money as well as time by substantially reducing the personnel engaged in servicing weather data. Engineering problems of the facsimile service were worked out through the Long Lines Department of the *American Telephone and Telegraph Company* in cooperation with the associated *Bell System* companies who provide the communication channels needed for the network. The system, as pointed out recently by Capt. G. D. Furlong of the Signal Corps, is making weather-reporting history. "It ultimately will make the conventional weather reporting for pilots obsolete," he says. "It eliminates the hazard of surprise changes in the weather which might, if known, alter the flight plan. Thus safety as well as the convenience of the pilot is served." The complete facsimile plan, Capt. Furlong reports, calls for a network of 166 stations throughout the country. A total of 77 are now in operation.

FACSIMILE CONTINUED to figure elsewhere in the Washington news during the spring, activities in the field highlighted by FCC meetings beginning March 15 to try to find out how far things had gone in the field, and what kind of futures there are. Like everybody else in electronics, the facsimile experts will tell you—as they told the Commission—that developments are unlimited and all they need is plenty of room on the radio spectrum to prove it. The Commission's problem is to find out how true the claims are—being radio claims, if the past is any indication, they are conservative—and then try to make way for the future in the overcrowded spectrum. That the FCC considers the facsimile problem one of its most serious was indicated at the March 15 meeting, when all FCC commissioners turned out. Facsimile representatives from a score of firms, including *Alden Products Company, Finch Telecommunications, Inc., Radio Inventions, Inc.* and *Faximile* (why didn't you think of that one?), were also present. Discussion hinged on how important it is for facsimile to get more room, how much of a public demand awaits it, and how efficient the service is today. The Commission is going to take some time, from all indications, to answer these questions, but the burden of the testimony seemed to indicate a couple or three interesting things that would bear remembering. As was the case with FM and television, facsimile is having a hard time getting started, but its public is steadily increasing. Now it's mostly professional—as used by the Air Force weather boys and for sending pictures to newspapers, to name a couple of services—but it has also reached at least some of the general public via facscasting of newspapers. We reported some of these activities in the last column. Testimony before FCC indicated that this type of work would increase beginning tomorrow. How fast is a question, but if the word of facsimile experts is an index, facsimile, far from still being in a semi-developmental stage, is ready to do business in as big a way as its cousins, FM and television. Full-blown activities in the field will not be as immediate as some hope, however, if former developments may be used as guide posts. Rules must be drawn—suitable to both the industry and FCC—concerning facsimile broadcasting. How much room is really needed must be determined. And then FCC and the facsimile boys are faced with a jackpot question—who's going to move over to make room? It's a tough one, and can't be answered overnight.

LONG AS WE'RE trying to peek into the future, might as well end on a Dick Tracy note. One of these days, we hear, broadcasting equipment, will, possibly, get its power from tiny capsules—buckshots of power—containing nuclear energy. This, in turn, may make possible wristwatch radios and pocket television sets. And we haven't been reading the comic strips, either. Just listening to no less an authority than David Sarnoff, president of the *Radio Corporation of America* and chairman of the board, *NBC* . . .

—30—

Universal Wattmeter

(*Continued from page 67*)

from terminals 3 and 4, and reconnect resistor R^2. This completes the simple calibration-adjustment procedure.

If it is desired to verify the voltmeter linearity; before R^2 is reconnected and the short removed from terminals 3 and 4, apply 5 volts to terminals 1 and 2, noting that the meter reads 0.5 ma. (exactly half-scale). Also, apply 2½ volts and note that the meter reading is 0.25 ma., or quarter-scale. Check as many voltages between 1 and 10 as desired.

The meter scale may be marked-off in watts according to the scheme given in Fig. 4. This requires no point-by-point calibration—the operator needs only to make his inscriptions according to Fig. 4. Very close graduation of the meter scale may be made by following the curve given in Fig. 5. It is best to make a special watts scale to replace the regular milliammeter card. Such a scale is seen on the author's meter in Fig. 1. A scale of this sort requires a certain amount of patience to draw, but it eliminates the confusion which is caused when the milliamperes and watts appear on the same card, and is well worth the additional time and effort demanded.

Using the Meter

The wattmeter described in this article is as simple to use as a voltmeter. The following procedure is recommended: (1) Determine the output impedance of the amplifier, oscillator, or other device to be tested. (2) Connect to terminals 3 and 4 a 100-watt resistor (preferably non-inductive) which has a resistance value equal to 1 ohm less than the impedance of the power-delivering device. It may not always be possible to obtain a resistor having the axact resistance value required. In this case, it will be necessary to use a wirewound unit with a slider set to the desired ohmic value. When the output impedance is 100 ohms or more, the external resistor connected to terminals 3 and 4 may be chosen *equal* to the impedance without introducing too much of a practical error in the wattage indications. When the impedance of the power-delivering device is 1 ohm, do not use an external resistor at all. Instead, short-circuit terminals 3 and 4. (3) Connect terminals 1 and 2 to the output terminals of the power-delivering device. (4) Read output watts on the meter scale. (5) Multiply this meter reading by the output impedance (ohms) when this impedance is higher than 1.

When checking the power output of an audio amplifier, disconnect the loudspeaker voice coil, connect terminals 1 and 2 of the wattmeter in place of the

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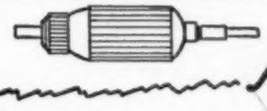

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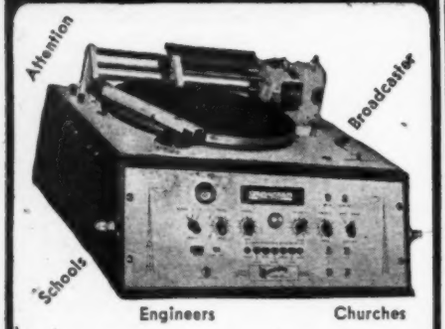

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voice coil, and connect a resistor to terminals 3 and 4 equal in ohmage to the voice coil impedance minus one ohm. This resistor must be rated to handle safely at least 2 times the power output of the amplifier. When checking audio amplifier power output, always apply a good *sine-wave* signal to the amplifier input terminals. 400 and 1000 cycles are standard test frequencies. Before disconnecting the loudspeaker for the wattage test, set the amplifier controls for maximum *undistorted* output.

When checking r.f. power, such as across a coaxial line, the wattmeter is used in the same manner just described for audio-frequency measurements, except that terminals 1 and 2 are connected to the r.f. output terminals of the device under test. When tests are made across a transmission line, the "far end" of the line must be disconnected. The *non-inductive* resistor connected to instrument terminals 3 and 4 must be equal in ohmage to the characteristic impedance of the line. When checking r.f. power, use the shortest possible leads between the r.f. source and the instrument terminals, and between the load resistor and instrument terminals.

The wattmeter must not be used in connection with circuits carrying d.c. Any d.c. component will produce an erroneous deflection of the meter and, if of sufficient voltage, will damage the crystal diode. Usually, some means of magnetic output coupling is available in each a.f. or r.f. power-delivering device. In every other case, use a large-capacitance coupling condenser in series with input terminal 1. No single value can be recommended for this isolating condenser, since the best microfarads value will depend upon the load resistance value and the operating frequency. Follow the rule of choosing a condenser of sufficient size (μfds.) that it will introduce little signal reduction at a particular operating frequency. What would be a satisfactory capacitance for one combination of frequency and load resistance might be unsuitable for another combination.

-[30]-

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Power Supply

(*Continued from page 68*)

Fig. 1C. In it a triode tube acts as the loss element. A tube is chosen which has considerable power-handling capacity and which can be run with the grid positive, such as one intended for Class B service. The output voltage is fed back to the grid through a bucking battery or gas-discharge tube, so that minor variations in output voltage appear directly on the grid and produce corrective changes in shunt current.

For example, a regulator was arranged using a 6V6G tube with the screen tied to the control grid in the high-mu connection, with four one-watt neon bulbs in series as a reference potential. The impedance of this combination as a shunt arm was found to be 400 ohms in the 250 volt region. When the regulator was applied to a light-duty power supply of 2000 ohms internal impedance, the regulated supply showed an internal impedance of approximately 330 ohms. This is the anticipated value, found by calculating the combined value of 400 ohms in parallel with 2000 ohms. The actual characteristics are shown in graph form in Fig. 2, where the ideal condition would be, of course, for curve C to be absolutely horizontal, representing zero impedance.

This circuit may be arranged to use tubes in parallel or to use one of the transmitting triodes. Its most promising application is to furnish bias to Class B or C amplifiers. For such services the supply may be a cheap, high-impedance device capable of furnishing only the few milliamperes necessary to maintain the gas-discharge, with all the advantages which would come from using a heavy-duty unit with a bleeder of several hundred ohms resistance. For example, a small transformer, half-wave rectifier, resistance-capacity filter, and 6V6 tube with one or two half-watt neon bulbs will be adequate for biasing a Class C r.f. amplifier of about one hundred watts input.

U. S. Patent 2,409,151, on this new circuit, is assigned to the *Western Electric Company, Incorporated.*

-[30]-

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CONTENTS

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(Continued from page 63)

wires and terminals you find in radio work are already tinned or can be easily made that way; so that takes care of number one. A good soldering iron, properly tinned and clean, takes care of number two. I have already told you how to tin the soldering iron, and don't ever let me catch you with it any other way. That thin coating of bright solder on the iron acts as a transfer agent to let the heat flow quickly from it to the connection being soldered.

"If possible, always hold the iron below the connection being heated," he went on. "Since heat rises, that speeds things up; but what is more important, excess solder will flow down onto the iron and stay there instead of falling inside the set where it could cause a short."

"I always thought you were supposed to pick up the solder on the iron and carry it to the joint," Barney said.

"That is okay if you are working in a tight place, but if you have room for both the iron and the solder—and you usually do—it is better to heat the connection for a few seconds before touching the solder to it. When the wires are already hot, the solder flows around them better. Don't take the iron away too soon, though, for you want to be sure to boil out the rosin that sometimes collects around a wire and makes a poor connection."

"Well," Barney said, poking around in the set, "here is one thing the character did a good job on. This coupling condenser certainly doesn't have any long leads. It is stretched tight as a fiddle string."

Without answering, Mac plugged the set in and turned it on. Then he tapped very gently with his pencil the condenser Barney was admiring. Every time he touched the condenser, the volume of the set would change abruptly, jumping first up and then down.

"What's the matter there?" Barney asked resignedly.

"The leads on that condenser were pulled so tight that the continuous strain has broken the connection between one of them and the foil. If he had left a little bit of slack in the leads, this would not have happened."

"Did the joker do *anything* right?" Barney asked.

Mac looked at the set meditatively. "Well," he finally said, "he didn't burn the insulation on any of the wires or melt the wax out of any of the condensers by not watching where he was putting his iron. That is to his credit. A good serviceman always clears things away and is careful so that his iron puts the heat just where he wants it and *only* where he wants it."

"He was really a dope," Barney mused. "Say, whose set is this that took such a beating?"

Mac picked up the tag and glanced

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at it. "It belongs to a Mr. Johnson at 2320 East Linden."

"Mr. Johnson! 2320 East Linden—Why that's—I was the one who—" Barney sputtered and then stopped while brick-red flush crept up his neck and slowly spread over his face until he looked like a summer sunrise.

"Yeah, I know; but don't let it throw you, son," Mac said kindly. "He told me that he had let the young man next door work on it a couple of months ago, and I remembered that you lived at 2318 East Linden."

"I should have had more sense than to work on it—or better say butcher it up," Barney said bitterly; "but he kept insisting that if I knew enough to build a transmitter I ought to know enough to fix a five-tube receiver. That's what *he* thinks—or thought!"

"That's one of the worst things about being eighteen," Mac mused. "You simply can't say, 'I don't know'; you have to go ahead and prove that you don't know. Of course, there is some faint hope for you. If you live long enough, you may just possibly outgrow it."

At his teasing words, Barney's customary grin crept back across his face. "You say the *nicest* things, Mr. McGregor," he murmured.

—30—

ELECTRICAL EXPOSITION

PLANS are now underway for the First Annual All Electrical Exposition to be held in the Pan Pacific Auditorium, Los Angeles, August 20th through 29th.

Sponsored by the Southern California Radio and Appliance Association, Inc., the show will feature radio, television, and electrical appliances. Representatives of these various branches of the industry are serving on the Exposition Committee which is headed by Fred J. Tabery.

Famous radio and television shows will emanate from the Auditorium stage. Pageants, parades, contests, and special events will highlight the activities of the ten-day exposition.

—30—

UAL HAM NET

EIGHTY United Air Lines' employees, who are amateur radio operators in their spare time, are forming their own ham net.

One of the company's pilots, Captain John Pincomb of New York, is contacting all United hams and putting them in touch with each other. Captain Pincomb says the membership in this unique net extends across the airline's routes from New York to Honolulu and from Seattle to San Diego.

Tentative time for going on the air has been set for 8 p.m. daily, local time in each zone. Each ham will send out the call "CQUAL" to let his fellow company hams know that he is on the net and wants to chat.

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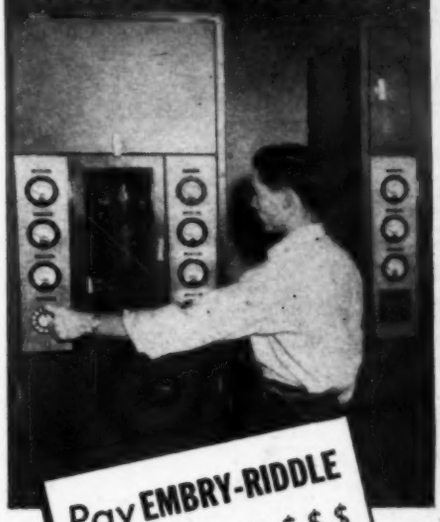

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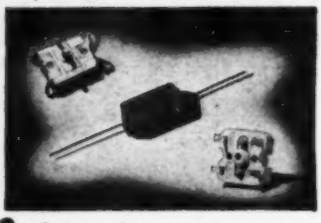

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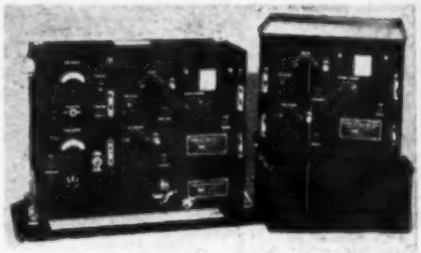

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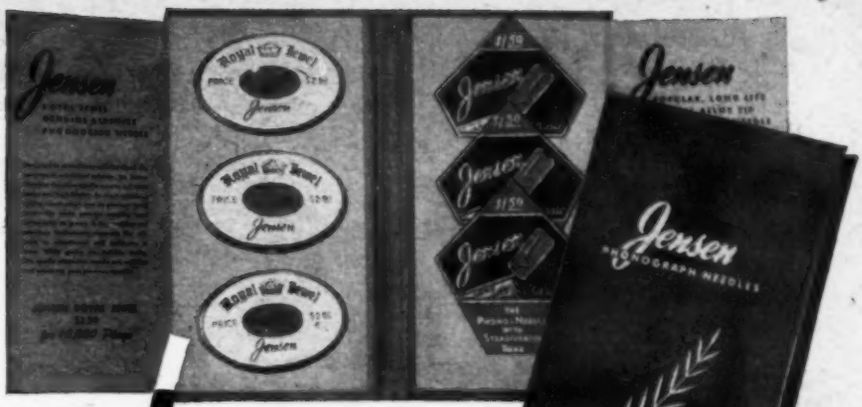

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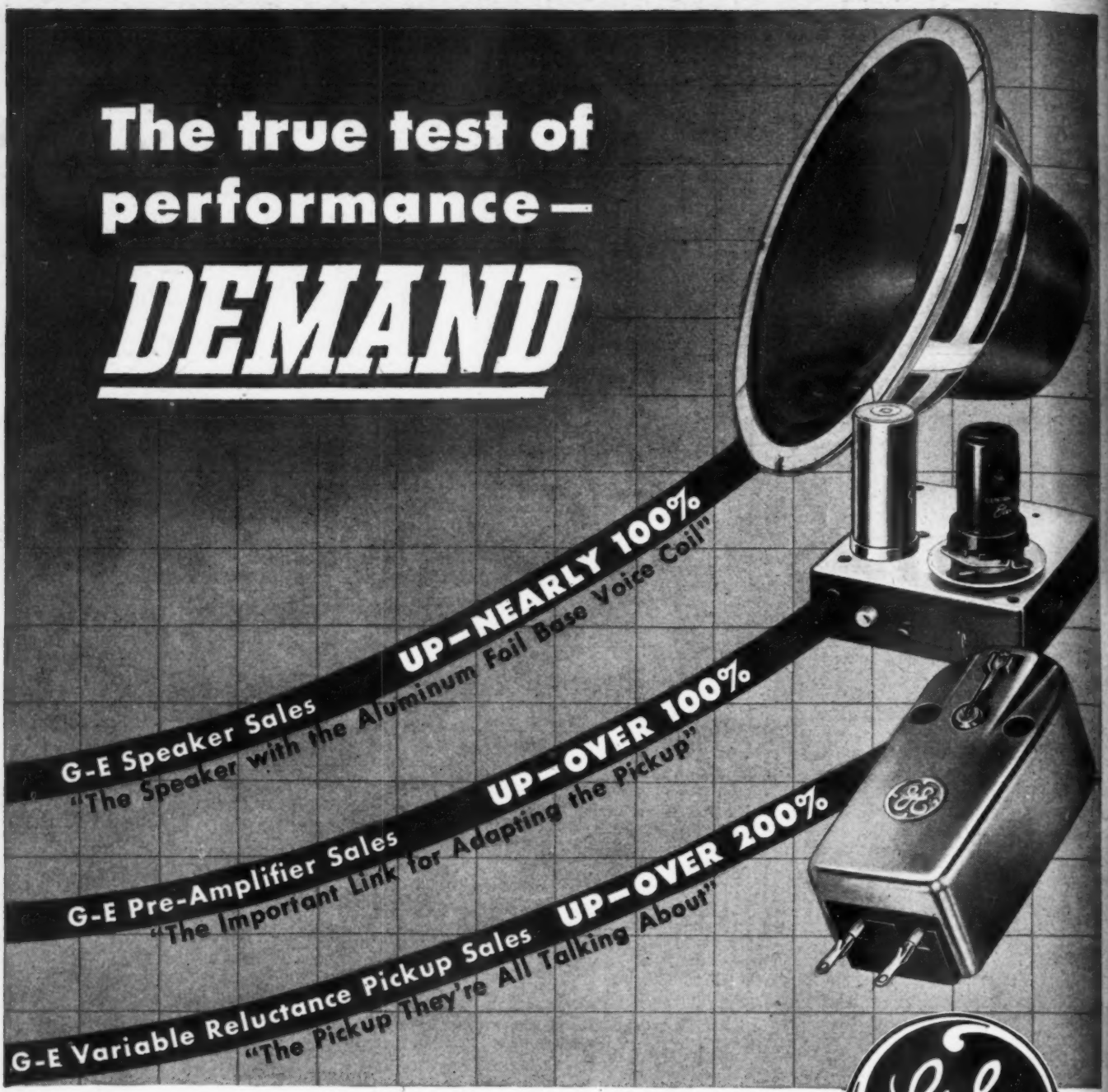
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